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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XXXIX, No. 19. FRIDAY, NOVEMBER 10, 1905.

The railroads which last week remonstrated against being required by law to use air-brakes on at least three-fourths of the cars in every freight train gave a striking picture of the difficulties which the present tremendous rush of freight has imposed on most of the big roads of the country. Yards everywhere are crowded, and every additional switch to get air cars to the front part of a train helps to limit the capacity of the yard and thus to delay freight, inconvenience shippers and inflict losses on consignees. New cars cannot be had as fast as they are needed, and old cars, which the owners had hoped to keep out of main line service, have to be kept in commission. A company which wants to enlarge its yards is unable to find contractors with equipment to do the grading. Whatever fault may be chargeable to the railroads by reason of their failure to put air-brakes on old cars, there can be no question that in the present situation it is important to keep in service every car that can carry freight. The method of doing this with the highest degree of safety was not touched on at the hearing; the roads were so busy arguing against a legal requirement that they forgot to emphasize the need of the self-imposition of the same requirement, regardless of the law—the requirement to use as many air-brakes as possible on every train. The more air-brakes used, the less the danger of damage from break-in-twos and from shocks in ordinary service. The danger from these causes is uncertain, yet on double-track and four-track roads it is potentially one of the worst to which the lives of passengers are subject; for a comparatively mild shock may throw a car body immediately in front of the fastest express train. Clearly, it is a duty, so long as non-air cars must be used, to run them at moderate speeds and to restrict their use as far as possible to single-track lines and lines on which passenger traffic is lightest. The Commission might well prescribe a higher percentage of air in trains on lines of heavy traffic than on those branches, referred to at the hearing, on which heavy cars cannot be run. The suggestion of Mr. E. E. Clark that the Commission should issue an order with the date far enough ahead to make reasonable a 100 per cent. requirement is impracticable (if the law be strictly construed), and Mr. Clark no doubt will on reflection so decide. With everything in perfect order, as in passenger-train service, all the cars in a train, if equipped, can be used; but why, after a 50-car freight train (all equipped) is made up, should the conductor be required to delay his own and perhaps other trains while he sets out two or three cars on which the air-brake apparatus is found to be out of order? The risk of danger from the presence of those cars in the train would be too small to warrant the delay.

"I cannot refrain from saying that John F. Wallace is a man in every sense of the word. After the unsparing manner in which Secretary Taft handled him when he resigned last June I surely would never have thought he or any other man in like circumstances would act so magnanimously. He is a man of rare patriotism and the finest moral timber."

This is a statement made last week by a member of the Advisory Board of Panama Canal Engineers, and is repeated here, not because Mr. Wallace needs rehabilitation among those who know his record, but because he has been ignorantly abused, and also a principle is involved. When, last summer, he resigned his position as Chief Engineer of the Panama Canal Commission, his motive was impugned by two of the most important members of this government, and their condemnation in language unworthy of high officers was printed by newspapers generally. He was accused of a lack of patriotism, of "deserting an army drawn up in battle line before an enemy." But the enemy in this case was simply a difficult engineering problem, and his army had already been made by him ready for battle, inasmuch as he had completed an organization, fully competent for its task—so efficient, indeed, that he modestly believed his loss would not be felt. In that plague-stricken region the Sanitary Department had accomplished little. He was stricken with fever and fully warned that his constitution was such that he could not live if he stayed. To live there, with the reward of great honor and high pay, was attractive. To stay a little longer and die, accomplishing nothing, was not attractive. The engineer has a right to life and liberty. In civil service or in corporation service he may honorably resign at any time if his record is clean. Mr. Wallace's record was not only clean, it was distinguished, and the occasion for the tribute printed

above is the aid which he is now giving, freely and patriotically to the Advisory Board in studying out the problems involved in making the Panama Canal a sea-level canal.

"The Track of the Future," an editorial in these columns several months ago (May 19, page 513), forecasted the form of rail support the railroads will adopt as a substitute for the wooden cross-tie system when these ties become too scarce or costly, and expressed the belief that it would be a longitudinal, continuous-bearing system composed of concrete beams on suitably disposed ballast for a foundation and rolled steel I-beams to carry the rails. We showed last week, page 426, a design of permanent roadway for steam roads proposed by a well-known engineer, which in essential features is in agreement with the ideas above outlined. Instead of parallel concrete beams under the rails, Mr. Schaub, whose scheme was first formulated several years ago, uses a single wide slab of reinforced concrete resting on a foundation of rubble concrete instead of ballast. This structure is rigid enough not to require longitudinal steel beams for rail support, the rails being secured to timbers bolted to the concrete. The previous article said that "it seems to be generally conceded that if some satisfactory form of longitudinal continuous support could be devised, the cost of which would compare favorably with the cross-tie system, it would meet with a prompt and hearty reception." Mr. Schaub's design, according to his estimate, would cost about $14,000 a mile, which is rather more than double the cost of present first-class construction. It was further said in the editorial before mentioned that the time may come when this cost consideration may become of less relative importance, and when difference in first cost may be offset by economies in the cost of maintaining track and equipment, due to better permanent way. The average yearly expenditure for track maintenance for all railroads has increased 50 per cent. in seven or eight years, the last available figures of the Interstate Commerce Commission showing that it costs to-day on an average $900 a year per mile of track for renewals of ties and rails and repairs to roadway, or a total of 188 million dollars, about 15 per cent. of the total operating expense; the figure for rails being $17,395,000; for ties, $31,213,000, and for roadway repairs, $139,213,000. But while the average for all roads is $900 a mile, in those sections where we find the densest traffic and the best examples of present track, this figure will reach $1,200 to $1,500. It is only for such lines, where the density of traffic and large expenditures per unit of track for maintenance would justify the consideration, that this permanent roadway is proposed.

An interesting light is thrown on the value of shop improvements by extracts from recent annual reports of two widely separated railroads. The Mexican Central report says:

"The operating expenses show a decrease for the year of $2,020,696, Mexican currency, brought about largely by economies made possible with new and economical locomotive and car shops, increased equipment of larger locomotives and freight cars and improvements to track and structures."

The report of the Boston & Maine says:

"The Boston & Maine has not in recent years possessed repair shops of such modern and up-to-date capacity as would enable the necessary locomotive repairs to be made within a reasonable minimum of either time or cost. This lack of needed facilities has, during the last three or four years, become so acute that some of the locomotive repair work has been done at outside shops. Many locomotives have been kept too long out of needed service during the winter season while waiting their turn in the already overcrowded shops."

The relative value of adequate repair shops to other improvements is too often underestimated. The repairs and maintenance of equipment represent from 16 per cent. to 30 per cent. of the total operating expenses as will be seen from the following table:

Road.	Maintenance of equipment.	Operating expenses.	Ratio.
Chesapeake & Ohio	$4,077,943	$13,250,966	30.8 per cent.
Norfolk & Western	3,917,268	14,614,434	26.7 "
Lehigh Valley	4,894,269	18,929,701	25.8 "
Pennsylvania	19,753,563	81,802,988	24.1 "
Lake Shore	4,340,250	21,627,046	20.0 "
Mexican Central	3,309,721	17,599,176	18.7 "
Chic., Mil. & St. Paul	5,181,586	32,294,041	16.0 "

About 90 per cent. of the cost of maintenance of equipment can be charged directly to repairs of cars and locomotives. Assuming that half the cost of these repairs is not affected by any improvements in shop methods or tools we have about 11 per cent. of the operating expenses on which to effect a possible saving by putting into use modern shop tools and facilities. It is a conservative estimate to say that a modern shop with electric cranes, individual motor driven machines using high-speed steel tools and good shop management will show a saving of 25 per cent. over an old shop of similar size or capacity. That is to say, nearly 3 per cent. of the whole operating expense may be so saved. Railroads do not hesitate to spend many millions every year in new locomotives of higher power, larger freight cars, new terminals, grade improvements and similar projects which produce only a fraction of the saving which might be had by the judicious expenditure of a less sum on their shop facilities. Good shops pay big returns on the investment.

TWO STATISTICAL TESTS.

Two statistical tests of conditions and processes in American steam railroads and of electric railroads are worth their passing attention. One is the capitalization of the steam roads of the country in stock and bonded debt, and its changes during the last four years. The second test is found in the official returns for the past year of the Connecticut electric roads as printed in the newspapers of that State in advance of the regular volume of the State Railroad Commission. Both tests throw light on somewhat different subjects, and from somewhat different directions. But both are significant of one railroad—and railway—times and methods.

Annexed is the table showing the capital stock and bonded debt per mile of steam railroad operated in the United States during the last five years:

	Per mile			Per mile	
	Capital stock.	Bonded debt.		Capital stock.	Bonded deb..
1900.....	$30,205	$29,967	1903.....	$30,719	$32,494
1901.....	30,521	30,811	1904.....	30,686	35,418
1902.....	30,439	32,377			

Thus during four years when the stock capitalization of American steam railroads per mile remained practically stationary, and, in fact, slightly decreased during the year 1904, the bonded debt ran up $5,451 per mile, or about 18 per cent. It proves rather strikingly that we are in a "bond period" of railroad construction—during the four years there is an increase of 18,912 in mileage operated—and probably, to an even greater extent, in a "bond period" of railroad financing of old railroad properties. The two classes of bonding obviously cannot be separated in the general returns. If they could they might supply some features of absolute as well as comparative interest.

The reasons for the growth of railroad bonding can easily enough be found, and have been conspicuous in latter-day financing of American railroads. The low bond interest rate of solid American railroad companies has been a steady and forceful incentive to the issue of that class of security to pay for improvements and extensions. While shareholders may, in some cases, look at it somewhat askance, in general it conforms with sound financing both from the viewpoint of stockholder and the public. To another category belongs the invention of extinguishing stock by bonds through the device of the "holding company," which has been characteristic of the four-year period. It is no small factor in the stationary stock mileage and the waxing bond mileage.

The second test from returns, to which we have referred, is of value as indicating what may be called the "natural" growth of electric railway earnings in a fairly typical Eastern State, Connecticut, which contains somewhat more than 700 miles of electric lines. There are no long distance lines, exactly speaking, but every other class—urban, suburban and cross-country—is represented. The advance returns show very generally increased earnings, gross and net. Thus the Hartford system, with 97 miles of track, returns an increase of gross earnings from operation of $64,638, or $32,839 net more than in the previous year. The Connecticut Railway & Lighting Company, with 171 miles, shows an increase in gross from $1,243,107 to $1,420,093, and in net from $404,564 to $582,477. The Consolidated Railway Company, with much larger properties in the State than the corporation just named, has during the year so changed as to prevent exact comparison of the returns. But the figures indicate a large increase, both in gross and net. Of the independent railway companies of the state, with completed properties, ten in number, all but two show additions to the surplus in their balance sheets. All this has come to pass, too, without any important additions to the electric railway system of the state, and with nothing, or next to nothing, to be credited to "novelty" traffic. It fairly represents a general tendency in a pretty highly populated commonwealth, and, apparently, with nothing ahead to check it, except industrial depression.

The two statistical tests, in two different branches of transportation, are, we repeat, not strictly cognate and relate to somewhat divergent elements. But, besides being synchronous, it is not amiss now and then to measure well-observed tendencies of rail transportation by the exactitudes of statistical returns.

A DEEP WATERWAY FROM THE GREAT LAKES TO THE MISSISSIPPI RIVER.

At the coming session of Congress the fate of the project to build a deep waterway from the Great Lakes to the Mississippi river will probably be decided. Throughout the central west the scheme, which involves the utilization of the Chicago drainage canal and considerable portions of the Des Plaines and Illinois rivers, has been persistently agitated by commercial and other associations for several years; but so quietly has the matter proceeded that comparatively few outside of the districts through which the canal is projected have known anything about it. As long ago as 1897 the General Assembly of Illinois adopted resolutions favoring the construction of such a waterway and in 1902 an appropriation of $200,000 was secured from the 57th Congress as a part of the River and Harbor Bill, the same clause creating a board of army engineers to carry out the necessary surveys and make a report. After three years' work the report has been submitted to the Chief of Engineers of the United States Army and will be transmitted to Congress with the board's recommendations. While the report has not been made public it is understood that it will not recommend the building of the waterway on the grounds of too great a cost for the commercial value of the project, although it is feasible to create a 14-foot channel from Chicago to St. Louis. This will probably result in the abandonment of the scheme for the present, at least. Elsewhere in this issue an outline of the project is given.

The desire that this ship canal should be built is a reasonable one. One needs study the map of the Mississippi Valley but a moment to realize that the existence of a waterway from the Great Lakes to the Gulf might almost have been expected as a provision of nature. As a matter of fact, such a waterway did exist in former ages, the geologists tell us; and in the natural course of geological processes now going forward, they say it will come into existence again in about 2,500 years. The barrier at present is a narrow strip of land separating Lake Michigan from the headwaters of the Des Plaines river, and it is this barrier that the drainage canal pierces. Although built primarily in the sanitary interests of Chicago, it is serving in a measure to restore conditions as they once existed, and anticipating those which it is predicted will occur again. An important and costly part of the work is, therefore, done. The remainder consists in deepening and otherwise improving portions of the channels of the Des Plaines and Illinois rivers and canalizing the Mississippi river for about 40 miles from the mouth of the Illinois to the deep channels below St. Louis, a dredged channel being impracticable.

It is conservatively estimated that the controlling works of the canal, which would be the restricting feature regulating the amount of traffic the waterway could accommodate, would permit the passage of a boat every 20 minutes in either direction. The maximum size of boat spoken of in connection with the proposed depth of 14 ft. is 4,000 tons, so that the maximum traffic capacity of the waterway reckoned on this basis would be more than eight million tons a month, or 100 millions a year. The 14-ft. depth would be available in the Lower Mississippi for a good many months in the year, although the low-water stages prevail over a larger portion of the year than the high-water, and the minimum at the present time between St. Louis and Cairo is 6 ft. Moreover, navigation is usually suspended from December 1 to March 1. The work that the United States Government is doing on the river between St. Louis and Cairo, which already has resulted in the 6-ft. minimum, is expected ultimately to increase this depth to 8 ft. This, of course, takes no account of the volume of water which the projected deep waterway would contribute, and which should further increase this minimum.

Just what traffic might reasonably be expected over the proposed waterway, no one appears to have attempted to estimate. It would seem that any great commercial advantage which such a waterway might be expected to yield would be largely conditional upon the existence of an Isthmian canal. The completion of the Panama Canal will convert the Gulf of Mexico into one of the most important bodies of water in the world, since it will then doubtless become, as it seems by nature intended to be, the outlet for the largest part of the tremendous volume of export traffic originating in the great Mississippi Valley, as well as a highway for world commerce. The Ohio and Mississippi rivers at the present time form the greatest internal waterway system in the world, except the Great Lakes. But while the river commerce has been declining, Great Lakes commerce in deep-draft vessels has increased enormously. It does not seem unreasonable, therefore, to assume that by uniting these two great inland systems and the Gulf of Mexico, with its great commercial promise, there would be established an avenue for traffic that would be an important factor in the business of transporting to tidewater the vast output of raw and manufactured products of this great region. Of course, the railroads would carry the greater part of the traffic as long as only a 14-ft. channel was assured for such a waterway, and that during a season averaging less than half the year. While a 20-ft. or deeper channel is, perhaps, practicable for that portion of the route at present projected, it is not by any means so certain that an equal depth could be attained and maintained in the Mississippi even with the expenditure of an enormous amount of work and money. The mere presence of such a waterway, however, might have some effect on railroad rates, even if the actual proportion of traffic using the route was small; just as the hopelessly inefficient Erie Canal controls the rates between the Atlantic Seaboard and the Central West, during the period of open navigation.

The Ohio Shippers' Association and the railroads of the state have entered into an agreement to settle by arbitration all disputes as to discrimination. J. W. McCord, of the Shippers' Association, says that the railroads will appoint a committee of three men and the shippers will appoint a like committee to confer upon all complaints; that the purpose is to have arbitration of all complaints, and that a plan of like nature is now in force as to car service and demurrage, and has proved satisfactory. This report has a beautiful rose color, and it is to be hoped that it is true, as well as rosy. Shippers' associations do not always hold together when most needed, and railroad committees sometimes turn out to be ropes of sand; but both are based on right and useful theories and ought to be encouraged. As long as railroads must act together in making rates it will often be a measure of economy to act together in dealing with shippers. The fact that many questions with shippers must be settled independently does not alter this fact. Shippers should unite for the simple reason that they are scattered and lack the power individually to carry on their own contests. As railroad organizations ought to be in the hands of traffic experts of broad views, so the traders should choose for leaders men free from the narrow notion that one city can successfully follow out the plan of getting everything for itself, regardless of the interests of other cities.

Chicago & North-Western.

The Chicago & North-Western operates 7,408 miles of line; the Chicago, St. Paul, Minneapolis & Omaha, operated separately but a part of the system, 1,683 miles. Together, as the "North-Western Line," they occupy the richest of the territory north and northwest of Chicago, and control a wonderfully large and profitable traffic. Incorporated in 1836 as the Galena & Chicago Union Railroad, and its first 10 miles of strap-rail track built in 1848, the Chicago & North-Western was the first railroad in Chicago, and had in consequence first choice of locations. To-day its 51 miles of double main track and 198 miles of other tracks form the most extensive system of terminals in the city.

In spite of its great success as a grain carrier, the Chicago & North-Western can hardly any longer be limited to the designation of a granger line, any more than a big city department store can be called a dry goods shop. With the wonderful development of its territory it has grown beyond, though not out of, its class. It is at least doubtful whether grain now furnishes the most important part of its business. Unlike most railroad companies, it gives no traffic figures of kinds of commodities carried, but certain of its traffic activities cannot be hidden.

The Chicago & North-Western has the largest live stock traffic of any road into Chicago. During the calendar year 1904 it carried into the city over 3,600,000 head—62,600 cars—of live stock. Its merchandise traffic north, northwest and west of Chicago is very large and profitable. In return, from these three radiating main lines and their branches and feeders, it carries, in its own refrigerator cars, very large shipments of perishable goods. On its Michigan peninsula division it has an iron ore traffic, earnings from which have been jokingly said to be large enough to pay the operating expenses of the entire system.

As these are only suggestions of some of the most important parts of the North-Western's business, there is no need of saying that the road is prosperous. Gross earnings last year were $55,745,275—$7,525 per mile of road. Net earnings, before deducting taxes, were $19,285,940, or $2,603 per mile of road. Taxes, which amounted to nearly 4 per cent. of gross earnings, were $2,189,977—$295 per mile of road. Gross earnings increased $2,410,641 over 1904, operating expenses $1,070,031, net earnings before taxes, $1,340,610, and taxes $352,171.

There were increases of $2,038,292 in freight earnings, $312,000 in passenger earnings, and $60,344 in express, mail and miscellaneous earnings. The total increase of over $2,400,000 in gross earnings

was not only notable in itself, but more particularly so on top of the large increases during the past few years. Gross earnings in 1904 increased $2,695,492 over the preceding year; in 1903, $3,198,659, and in 1902, $3,545,534, an average increase for the four years of over $2,960,000 a year. As the dividend rate (8 per cent. on the preferred and 7 per cent. on the common stock) has remained unchanged during this time, and requires by no means all of the net income, it might be supposed that much of the surplus had been turned back on the road in improvements, but it would hardly be expected that this had been done in so liberal a fashion as is the fact. Of the $5,816,315 "construction charges" during the past year, $4,600,000 was charged against income. In 1904 $4,000,000 was appropriated out of income for improvements; in 1903, $5,013,417, and in 1902, $4,697,055. Although the year 1902 marked the beginning of the recent series of nearly three million dollar annual increases in gross, appropriations for improvements had in the two years previous to that time been almost equally as large. There was spent in 1901, out of earnings, $4,169,526, and in 1900, $4,542,041. This is a total appropriation out of earnings for additions and improvements for the six years of $27,022,044, against $27,560,118 paid out in dividends during that period.

Naturally, the physical condition of the road has been brought to a very high standard. At the same time, the management has not been behindhand in extending its lines at various points necessary to safeguard, maintain or extend its traffic. Each year the building of new branches and extensions have been undertaken by constituent companies, to be absorbed on completion by the parent organization.

Three such subsidiary companies are mentioned in the present report. One of these, the Manitowoc, Green Bay & North-Western, is to build 114 miles of line which will more closely unite the Ashland and peninsula divisions and effect important savings in distance, grades and curvature.

The Milwaukee & State Line is building a continuation of the third and fourth main tracks of the Milwaukee division, now terminating at Lake Bluff, and generally known as the Lake Bluff cut-off, to a point near Milwaukee. This is an extension of the plan adopted a few years ago of relieving the very heavy traffic of the Milwaukee division, which, aside from its ordinary large business has probably the largest suburban traffic of any one line into Chicago, by separating the through freight and passenger, from the local and suburban passenger tracks. The first step in carrying out this plan was the building of a cut-off from Mayfair, on the Wisconsin division, north to Evanston, 12 miles from Chicago, on the Milwaukee division, together with a freight cut-off south from Mayfair to the West Fortieth avenue freight yards. Soon the suburban business began to encroach on this new line. In order to get the freight and through passenger trains promptly into the Chicago terminal district it was found necessary to extend the cut-off, or rather, build a new one, from Mayfair north to Lake Bluff, on the Milwaukee division, 18 miles north to Evanston, over which the third and fourth tracks were carried. This cut-off, in its turn, has been found insufficient, and the additional track construction now under way will carry the third and fourth tracks the entire 85 miles between Chicago and Milwaukee.

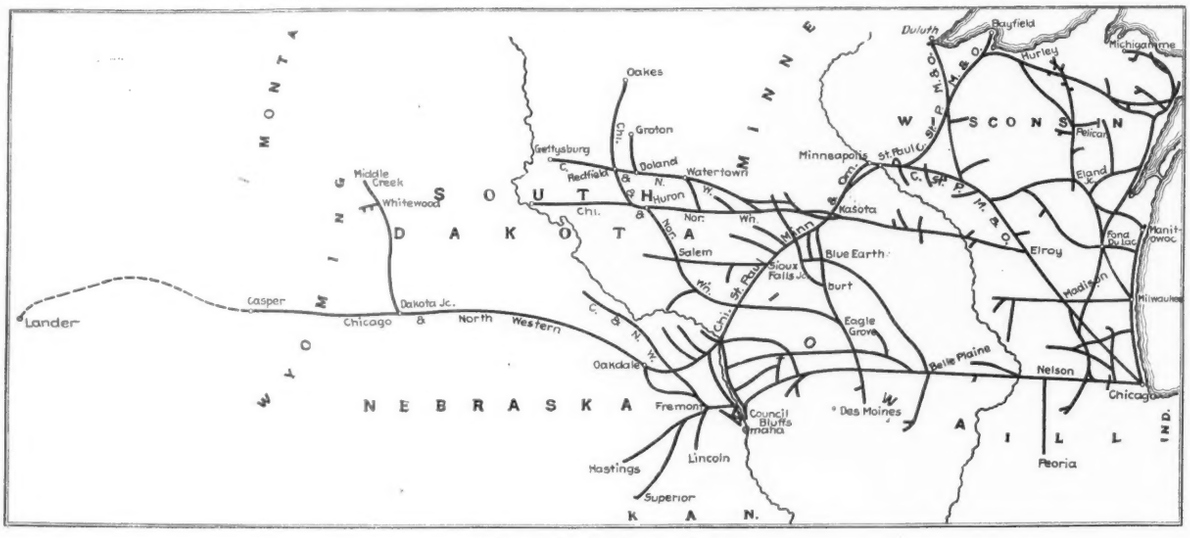
The third subsidiary company is the Wyoming & North-Western, which has already (November 1) laid track on eight miles of its line from Casper, Wyo., the farthest western point reached by the North-Western, west via Wolton and the new town of Shoshoni to Lander, at the edge of the Wind River, or Shoshone Indian Reservation, which is to be opened to settlement next June. This will bring the Chicago & North-Western to a point almost directly north of the Colorado-Utah boundary.

Another piece of new road to the westward, not mentioned in the report but already under construction, is a line from Pierre, S. Dak., west 150 miles to Rapid City, now reached only by a branch of the Chicago & North-Western's Wyoming line. It is interesting in this connection to observe that the company's closest competitor, the Chicago, Milwaukee & St. Paul, is also building a line from its present terminus at Chamberlain, S. Dak., 200 miles west to Rapid City; so that both companies are filling in the gap between their present termini on the Missouri river and the Black Hills region.

Track elevation in Chicago is a betterment—enforced to be sure—which has taken large sums of money for improvements. With more than twice as much track in Chicago as any other road, the Chicago & North-Western has for the past several years spent in this way very large amounts, and considerable expensive work is still to be done in the elevation of some of the freight lines within the city.

The improvement policy has had its effect not only in making it possible to actually handle the large increases in traffic but to handle traffic more efficiently. The number of passengers carried one mile last year increased 16,000,000, and the number of ton miles 226,000,000, yet the cost of conducting transportation showed a decrease of $194,000.

The cost of locomotive fuel, to be sure, had much to do with this. In 1904, with an increase of nearly 1,000 miles in the average mileage operated (due to a full year's operation in 1904 of the absorbed Fremont, Elkhorn & Missouri Valley Railroad), conducting transportation increased $2,000,000 over the preceding year. Of this



Chicago & North-Western.

increase, nearly $1,000,000 was in the one item of locomotive fuel. Last year, with practically no change in mileage, this expenditure decreased $360,732, or nearly twice the total decrease in conducting transportation.

It is interesting, in view of the large increase in traffic, to notice the principal changes in the items under the head of conducting transportation. As is natural, there was a general increase in the amount of wage payments. Agents received $21,000 more, switchmen, $48,000, and engineers and firemen, $66,000 more than in the previous year. Freight train supplies increased $30,000, while on the other hand locomotive supplies decreased $10,000; station supplies, $65,000; oil, waste and tallow for locomotives, $18,000; damage and loss of freight, $27,000, and personal injuries, $72,000. On the whole, this seems a very creditable showing. Of the total operating expenses of $36,459,335, conducting transportation took 58.9 per cent.

Maintenance of way cost $7,466,944, 20.48 per cent. of the total operating expenses, not including taxes. There were 420 miles of track replaced with heavier rails and 2,977,941 new ties laid. New ties cost $364,872 more than in 1904, an increase of one-third. Maintenance of way cost $1,008 per mile in 1905, against $968 in 1904.

Maintenance of equipment expenditures ($6,419,190, an increase of $909,446 over 1904) were 17.61 per cent. of operating expenses. Under this account, 48 locomotives, 8 passenger cars, and 1,800 freight cars were acquired for replacement and charged to operating expenses, against 1 passenger car and 1,675 freight cars acquired in 1904. General repairs of locomotives cost $1,999,791, of passenger cars $478,340, and of freight and work cars $1,541,266. Including cost of renewals and a proportionate share of the other charges, this

works out at $2,260 per locomotive, $521 per passenger car, and $55 per freight car, against $1,749 per locomotive, $446 per passenger car, and $53 per freight car in 1904.

Eighty-five per cent. of the total increase of $1,070,031 in operating expenses was in maintenance of equipment, 28 per cent. in maintenance of way, and 5 per cent. in general expenses. The decrease in conducting transportation was 18 per cent. of the amount.

The $13,339,714 passenger earnings, a decrease of $312,005 from 1904, came $9,094,656 from first class, $2,289,967 from round-trip, and excursion, and $1,796,856 from commutation passengers, together with $74,288 from emigrant passengers, and $83,948 from parlor car fares. The large proportion of passenger earnings (13 per cent.) coming from commutation fares, shows the importance of the Chicago & North-Western's suburban traffic. There were 661,289,753 passengers carried one mile, or 89,267 per mile of road, against 87,125 per mile of road in 1904. The average distance each passenger traveled was 31 miles, and the approximate earnings per mile run by passenger trains were $1.09 against $1.06 in 1904.

The number of tons of freight carried one mile per mile of road last year was 579,434, against 549,182 in 1904. The average earnings per ton mile were 0.92 of a cent in both years. The average distance each ton was carried decreased 7 miles, from 145 miles in 1904 to 138 miles in 1905. The steady increase in earnings per freight train mile during the past few years is very noteworthy. They have increased from $1.96 in 1900 to $1.98 in 1901, $2.02 in 1902, $2.05 in 1903, $2.07 in 1904, and $2.19 in 1905, the latter an increase of 6 per cent. over the preceding year and a record figure in the company's history.

The balance sheet shows $224,443,272 charged to cost of property, an increase of a little over $1,000,000 over 1904. Against this is outstanding $22.395,120 preferred stock and $48,335,938 common stock, a total of $70,731,058, or $9,548 per mile. The funded debt outstanding is $152,915,500, or $20,642 per mile. The company is exceptionally strong in its small total capitalization of $30,189 per mile of line, and in this respect reflects many years of the most conservative financial management.

With a territory as rich as any in the United States, a double track line to Omaha (the only double track line between Chicago and the Missouri river), a close traffic connection at that point with the Union Pacific, a first-class line to Minneapolis and St. Paul, an exceedingly profitable iron ore traffic on the Michigan peninsula, the investment of large amounts of surplus earnings in improvements, high operating standards, and splendidly conservative management, the Chicago & North-Western easily ranks as one of the strongest railroads in the United States.

The Chicago, St. Paul, Minneapolis & Omaha, whose lines are included on the accompanying map, shows gross earnings of $11,926,000, operating expenses of $7,676,528, and net earnings of $4,249,472. After payments for interest and rentals and an additional appropriation of $400,000, for additions and betterments, 7 per cent. dividends were paid on both classes of stock. These amounted to $2,086,861, of which $982,400 went to the Chicago & North-Western as dividends on its 147,000 shares of Chicago, St. Paul, Minneapolis & Omaha stock owned. These, by the way, are carried in the Chicago & North-Western balance sheet at $10,000,000, on which valuation the investment pays nearly 10 per cent.

For the Chicago & North-Western the principal operating figures for the year are summarized below:

	1905.	1904.
Mileage worked	7,408	7,404
Freight earnings	$39,292,830	$37,254,539
Passenger earnings	13,339,714	13,027,708
Exp., mail and miscellaneous	3,112,731	3052,387
Gross earnings	55,745,275	53,334,634
Maint. of way and structures	7,466,944	7,166,308
Maintenance of equipment	6,419,180	5,509,734
Conducting transportation	21,460,447	21,654,456
Operating expenses	36,459,335	35,389,304
Taxes	2,189,977	1,837,805
Net earnings, after taxes	17,095,964	16,107,525
Gross income	57,281,110	54,823,864
Net income	10,417,822	9,399,741
Surplus for the year	5,242,898	4,224,817
Appropriations for betterments	4,600,000	4,000,000

NEW PUBLICATIONS.

Proceedings of the Thirty-eighth Annual Convention of the American Railway Master Mechanics' Association, held at Manhattan Beach, New York, June, 1905; Joseph W. Taylor, Chicago (Old Colony Bldg.), Secretary.

The majority of our readers are so familiar with the contents of these volumes from year to year that a detailed review of the present volume is not necessary. Aside from the association's rules and standard committee reports and topical discussions, it contains two individual papers, one on the "Technical Education of Railroad Employees" by G. N. Basford, of the American Locomotive Company, formerly editor of the *American Engineer and Railroad Journal*, and the other on the "Use of Superheated Steam on Locomotives" by H. H. Vaughan, of the Canadian Pacific. The volume contains 411 pages, which is somewhat smaller than the last year's volume, which had 552 pages, the largest one ever published by the association. The index is in substance, arrangement and typography a model in bookmaking. It makes all the information quickly available to a busy man.

TRADE CATALOGUES.

Foundry Information.—The latest number of the Obermayer Bulletin, published by the S. Obermayer Company, Cincinnati, Ohio, contains articles on "Aluminum, Silicon and Phosphorus," by F. J. Davis; "Partamol," a new compound for parting molds, a paper read before the Philadelphia Foundrymen's Association; "Molding and Casting a 15-ft. Fly Wheel," by H. Krohmer; "Foundry Facings," by E. D. Frohman, a paper read before the American Foundrymen's Association meeting at New York; and "Plumbago, Sea Coal and Core Wash." There is also considerable other information of interest to foundrymen.

Convertible Cars.—The Rodger Ballast Car Co., Chicago, has issued a "reference book" on its Rodger ballast Hart convertible cars. It is a convenient pocket size and illustrates and describes the various types of gondola, flat, box and stock cars all convertible into self-clearing hoppers. Half-tone engravings show various views of the different types, and engravings from line drawings show the general construction and principal dimensions. Cross-sectional views illustrate the methods of handling materials in these cars. The booklet will be sent free on application.

The Chicago & North-Western is distributing folders giving information concerning the industrial opportunities on its lines. A list of industries now wanted is given, together with a considerable list containing brief descriptions of factory buildings now available for immediate occupancy. Other business opportunities are enumerated, and an outline is given of the new lines being built by the road to open up new territory hitherto undeveloped. Other advertising literature includes a circular regarding the enormous crop being harvested in the northwest and announcing homeseekers' excursions to that region; and a pamphlet illustrating and describing the new equipment of the "Overland Limited," its crack Pacific coast train.

Steel Lath.—The Northwestern Expanded Metal Co., Chicago, sends an artistic eight-page pamphlet regarding its "Kno-Burn" steel lath. The advantages of steel lath over wooden lath are set forth and directions given for its application. The desirability of this lath for use in the cement exteriors for dwellings that are coming into vogue, is dwelt on, and also the small increased cost of concrete-steel construction over wood and the manifold advantages and superiority of the former. Half-tone engravings show both the standard and diamond mesh lath and weights and essential dimensions are given.

Hydro-Electric Power Plant.—Bulletin No. 13 of the Arnold Company, Chicago, is a description of the hydro-electric plant of the Spring River Power Company, Joplin, Mo., largely reprinted from articles in *Engineering News* and *Western Electrician*. The description is complete and is fully illustrated by half-tones and engravings from line drawings. The pamphlet is 9 x 12 and contains 14 pages.

Draft-Gear and Air-Brake Tests.—The Westinghouse Air-Brake Company, Wilmerding, Pa., sends a neatly gotten up pamphlet in which is given an interesting detailed account of the air-brake and draft gear tests recently made by the Westinghouse Company under the auspices of the Lake Shore & Michigan Central Railroad at West Seneca, New York.

Friction Draft Springs.—The Frost Railway Supply Company, Detroit, Mich., sends a catalogue descriptive of the Harvey friction draft spring. Illustrations showing this spring in cross section, under various stages of compression, are given, as well as diagrams in which the results of both compression and drop tests of the spring are shown.

Electric Storage Batteries.—The Westinghouse Machine Co., East Pittsburg, Pa., sends a small folder descriptive of the Westinghouse storage batteries for railroad signal service. The first few pages are devoted to explaining the merits of this new battery, and the remainder of the folder contains detailed illustrations of its various parts.

Iron and Steel Works Equipment.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, sends a handsome catalogue in which is illustrated various designs of heavy cranes especially designed for use in iron and steel works. A number of full page half-tone illustrations showing these cranes installed in well-known works are also given.

Valves.—The October issue of *The Valve World*, published by the Crane Company, Chicago, contains a number of interesting articles, including the "Beginning of the Manufacture of Wrought-Iron Pipe in the United States" and "The Growth of Artificial

Refrigeration." It also contains a description of the Crane quick-acting, self-opening steam radiator valve.

Concrete Building Blocks.—The American Hydraulic Stone Co., Denver, Col., sends a 15-page pamphlet describing its system of concrete building block construction. Views of a number of public buildings, residences, business blocks, etc., built of these blocks are shown, and testimonial letters from engineers, architects, etc., are included.

Stone Channeling Machines.—The Ingersoll-Sergeant Drill Company, New York, sends its catalogue No. 60 in which is illustrated and described various designs of stone channelers made by the above company. A number of half-tone illustrations are also given in which these machines are shown in actual use.

Machine Tools.—The Gisholt Machine Tool Company, Madison, Wis., sends pages 37 and 38 of its loose leaf catalogue showing the latest method of attaching a motor drive to the Gisholt lathes. An illustration of a 13-in. lathe is also shown, this being the smallest lathe made by the company.

Graphite.—The Joseph Dixon Crucible Company, Jersey City, N. J., is distributing its November issue of *Graphite*. It contains an interesting article on steam and return pipes for heating systems, by W. H. Wakeman, as well as its usual amount of short talks on graphite and its various uses.

Alternating Current Generators.—The National Electric Company, Milwaukee, Wis., sends its Bulletin No. 358 in which it illustrates and describes in detail its full line of belt-driven alternating current generators.

Electric Storage Batteries.—The National Battery Company, Buffalo, N. Y., sends its Bulletin No. 3, in which it illustrates and describse its electric storage batteries of the "Unit Accumulator" type for car lighting.

CONTRIBUTIONS

Honeycombing Flue Sheets.

South Portland, Me., Oct. 31, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the editorial in the *Railroad Gazette* for October 27, regarding the honeycombing or capping of tube ends complained of by some of the western roads, the Boston & Maine experienced the same difficulty when burning "Otto" coke on their through passenger runs, and had to abandon its use on that account. This coke, I understand, is wet down (on coming from the retorts) with salt water, which may account partly for this action. I cannot say whether they tried thimbles in the tubes, but it seems to me that would have helped the matter and will no doubt prevent to some extent the capping with the western coals, the idea being that the sharp edges of the thimbles will tend to break the cinders. They certainly will not adhere as readily to a sharp edge as on the rounded or beaded ends of the tubes. At the same time the shoulders of the thimbles will protect the ends of the tubes from abrasion.

J. V. N. CHENEY.

Oct. 30, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is quite a common thing in the west to have flues honeycombed, even with hand-firing, as I have seen different instances where the flue sheet is practically plastered over with a mass of clinker. You state in your editorial note that the stoker occupies the fire door and makes it inconvenient to use the scraper. As a matter of fact, this method of putting the stoker in the fire door must only be a temporary or an experimental one. The regular arrangement which has been devised for this, in connection with the stoker, gives a regular fire door above the place occupied by the stoker, so that this can be opened and access had to the fire-box, either by means of tools or, when the fire is extinguished, by permitting a man to crawl inside in the usual way and do any work that may be necessary without in the least interfering with the stoker. This may serve to destroy any apprehension which your readers might have in regard to the inaccessibility of the fire-box when the stoker is in use.

G. R. HENDERSON.

Jersey City, N. J., Oct. 31, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I note with interest your editorial in the issue of October 27 referring to the difficulty in using automatic stokers on account of a coating gathering on the sheets and flues. I have known trouble of this kind to develop under strong forced draught and the accompanying intense combustion. I have understood that this peculiar coating can only be developed under like conditions. It is possible that with the automatic stoker at work and with the powerful draught applied to locomotive furnaces from the exhaust, that like conditions to those I refer to may be developed and this peculiar substance liberated in locomotive furnaces fired with the automatic stoker. I have found that steam jets under the grates of a closed furnace have overcome this trouble to a considerable extent in marine service, and it is possible that steam jets, either above or below the grates, might contribute to some extent in overcoming the trouble referred to where the automatic stoker is used.

W. M'INTOSH,
Supt. Motive Power, C. R. R. of N. J.

Middletown, N. Y., Oct. 31, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Although we have never used the automatic stoker and consequently cannot say very much about its use, we are much interested in its application. Our traveling engineer tells me that at the last convention of the Traveling Engineers' Association held at Detroit a few weeks ago, automatic stokers were very thoroughly discussed and no one complained of the coating of the flues referred to in your editorial note in the issue of Oct. 27. At one time when we were burning a certain grade of coal we had this same trouble until we applied the Bates fire-door, which allows a large amount of air to pass into the firebox. This practically remedied the trouble. I would suggest a greater amount of air be taken in the firebox as an experiment.

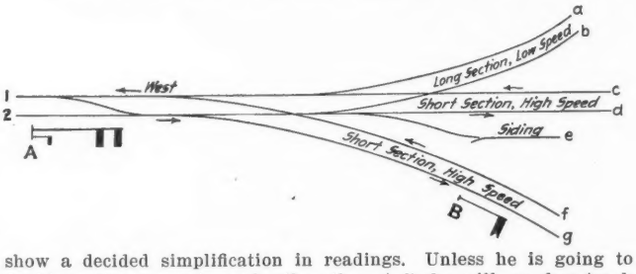
GEORGE W. WEST,
Supt. Motive Power, N. Y., O. & W.

Arrangement and Forms of Signals.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest the communication from Mr. Henry Johnson, published in the *Railroad Gazette* of October 27, page 387. While Mr. Johnson's long experience and his thorough knowledge of signaling in England compels one to respect his views, the fact that Americans have for these thirty or forty years ignored the English idea of using more than one post for the signals of one track leads Yankees to question seriously the propriety of making a change at this late day.

It seems to me that to justify his proposition he should show a saving in the total number of signal arms, and further, should



show a decided simplification in readings. Unless he is going to fix his posts nearer to each other than 4 ft. he will, on four-track lines, labor under the serious disadvantage that his signals for parallel tracks are not far enough apart to produce as much difference as there should be between the bracket post, as shown in his letter (for one track), and the bridge signals which he would use for two parallel tracks.

Under the approved American practice of to-day, such as you will find on the four-track sections of the Pennsylvania, the signal to be used at the point of divergence into the three divisions which are shown by Mr. Johnson, would be as indicated at *A* in the drawing below. In this arrangement the upper arm is cleared for the route *d*, the second arm for *g*, and the dwarf arm for *b* and *e*. The defect in this arrangement is that—as it is necessary, in order to adhere to a consistent principle, to have the second arm indicate less than the highest speed—we unnecessarily restrict the speed of trains running to *g*. But, on the other hand, we secure the advantage of simplicity. Four-track lines are now found on many roads, and this Pennsylvania arrangement of a second arm to indicate a second grade of high speed, which was designed primarily for No. 20 crossovers at which one fast train needs to run around another which is moving in the same direction, is simple and logical for all situations. The situation at Mr. Johnson's junction might be met either by submitting to this reduction of speed, say, from 65 or 70 miles an hour to 45 or 50 miles, or by putting into the rules an exception for this junction. Surely, the junctions at which both of two diverging lines may be traversed at the highest speed are not going to be very numerous on any road. For that matter, it may well be claimed that this double junction is not a common situation, or at any rate should not be. It would be worth while to make a change in the location of a switch, if it could be done at moderate cost, to avoid the complicated arrangement of arms which Mr. Johnson provides. It is true that the arrangement of five arms on a single post has a tendency to mystification, but it will be hard to convince American

engineers that the same is not in a considerable degree true of Mr. Johnson's arrangement.

The two distant arms which Mr. Johnson shows on his bracket post might reasonably be put somewhere else. Either the distant signal in the rear of *A* should be kept against trains running to *g* or else there should be a separate distant at *B*. The same argument applies to the route to *d*. Rather than have Mr. Johnson's bracket post I would put the two distants on a separate post six or eight feet farther away from the track. Another way would be to put the lights for the distants 12 or 18 in. to the right of the post. Still better would be Mr. Vernon's double lights for the distant arms (one on each side of the post, both at same level). By day the forked arm would differentiate the signals.

Both Englishmen and Americans give undue importance to the theory of grouping as many signals on the same post as possible. In some other things money is spent liberally to make possible the use of a correct theory, while in this matter we seem to be blind to everything except saving in cost.

Why is it desirable to confine oneself to the principle of having only one home signal on a post? Signal engineers frequently discuss the dire possibilities of an extinguished light, and some of them have lately said a good deal in favor of having two lights on all posts everywhere. But when has trouble ever occurred from this source? Trouble, I mean, which was fairly chargeable to the signal department. Locomotive engineers will now and then get themselves into trouble with any possible arrangement of signals, but it is not the function of the signal engineer to provide against such lapses.

One important principle espoused by Mr. Johnson receives insufficient attention in this country; that is, the principle of obscuring a dwarf signal until the engineman comes within a comparatively short distance of it. Proper consideration of this point would settle some of the signal engineers' difficulties. Everybody is working all the time, more or less persistently, to get rid of unnecessary red lights, yet the red lights on dwarf signals constitute one of the most unnecessary elements of confusion to the runners of fast trains. This point was touched upon briefly in one of the discussions at Niagara Falls last month. I was sorry to see, however, that even the best informed speakers ignored the need of blinding those dwarf signals which are used for back-up movements on the main line. At interlockings situated on curves red lights in these signals unnecessarily disturb the runners of fast trains on the other tracks; or, if the runners have become hardened to them the lights become an element of danger, as by reason of their existence the runner unconsciously relaxes the vigilance of his lookout for other red lights. Not long ago there was a rear collision in which the engineer at fault claimed that the red lights in a caboose some distance ahead, on an up grade, appeared to him exactly like the red lights in certain dwarf signals.

Those roads which have adopted the practice of blinding every dwarf signal light when it is in the stop position are, I believe, fully satisfied with the idea. Those which use purple glass for the stop indication are also well satisfied; evidently they are afraid of the radical idea of blinding the light; they secure all of the advantages of blinding, for the purple will never be mistaken for red.

Mr. Johnson's suggestion about train-order signals evidently is born of his English experience, for the American railroad superintendent wants his train order signal to be so arranged that it can be used to hold the train for orders. This cannot be done after the engine has passed the signal. The only completely satisfactory arrangement is to have separate signals for the two directions and to fix each in advance of the station. At the same time, Mr. Johnson is right in saying that there is no need of a separate design of signal. As in the case of the automatic signal, if, after the engineman has brought his train to a stop, he does not know enough to find out why he has been stopped, and to get all necessary additional or auxiliary information, he is a pretty dull fellow.

In suggesting the use of two stop signals at a draw bridge in lieu of a derailing switch (where the derailing switch is supposed to be impracticable) Mr. Johnson again brings in an English idea. Does any American railroad officer favor this? It would be highly interesting to bring out the actual state of sentiment on this point. It is to be admitted that some American roads have gone to the absurd extreme of putting in a derailing switch which would almost surely throw a train into the river; but the rational use of the derailing switch or diverging track is the only true solution. If one is not willing to go to the expense of arranging a derailer or diverter in a reasonably safe manner, he ought to pay the penalty by being required to run all of his trains at low speed for several miles on both sides of the drawbridge.

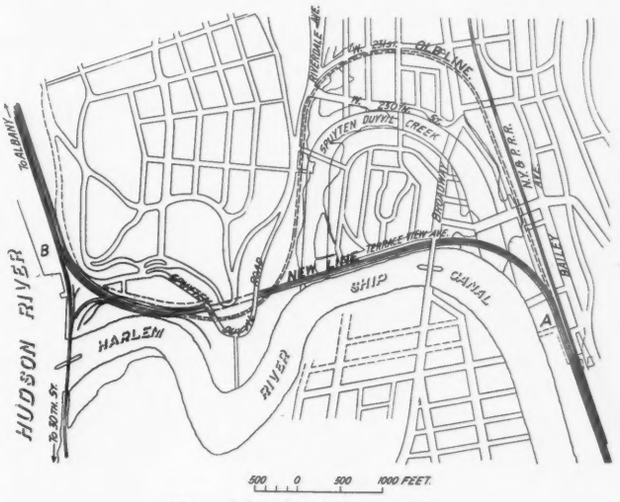
S. G. A.

Improvements of the New York Central & Hudson River Within the Electric Zone.*

A previous article (*Railroad Gazette*, Oct. 20, 1905, p. 366) outlined the improvements now being made by the New York Central within the electric zone and described in detail the work being done south of the Harlem river, rebuilding the Park avenue tunnel and excavating for the new Grand Central yard. This article will describe other important improvements farther out.

Marble Hill Cut-off.

This change of line, now under construction, leaves the present main line at a point about half a mile south of Kingsbridge and

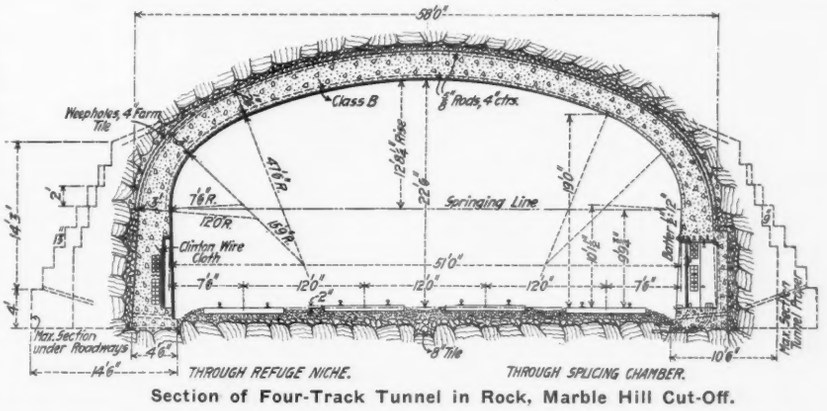


Map of Marble Hill Cut-Off.

swings west across Spuyten Duyvil creek, under Broadway and along the north shore of the Harlem river ship canal by Marble Hill, again across Spuyten Duyvil creek, and through Spuyten Duyvil hill in a four-track, single arch, rock tunnel to the point of connection with the present line just south of Spuyten Duyvil station. By the new line seven grade crossings are eliminated, and the line is shortened about three-quarters of a mile, saving also about 138 deg. of curvature. The new line is to be four-track throughout.

The special feature is the concrete-lined, four-track tunnel, which will be about 660 ft. long, and which so far as the writer is aware, will be the only four-track single arch rock tunnel in the world. Two short span fixed bridges will span Spuyten Duyvil creek, and crib bulkheads will sustain the new four-track roadbed along the ship canal.

The plans provide for a new station to be known as Marble Hill where the line crosses under Broadway, to take the place of

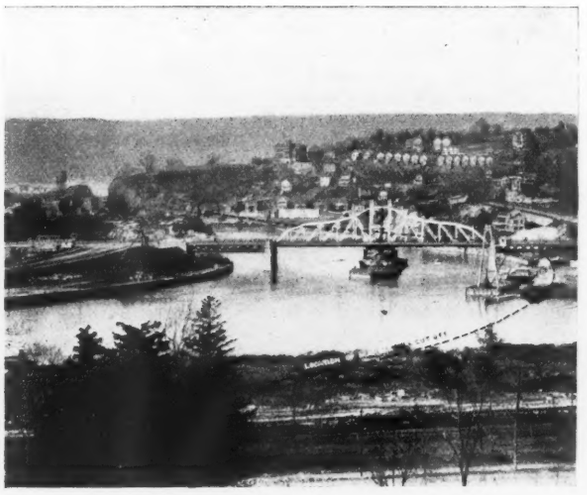


Section of Four-Track Tunnel in Rock, Marble Hill Cut-Off.

the present main line station at Kingsbridge, which will be abandoned after the new line is in operation. This station will be on the line of Broadway with stairs and baggage elevators leading from a concourse over the tracks to the platforms. As the Rapid Transit Subway crosses the ship canal on the Broadway bridge, a station will be located at the end of the bridge adjacent to the new Marble Hill station, and stairways with elevators will be arranged to allow convenient interchange of passengers between the two lines. Thus with the conveniences proposed at Grand Central Station there will be two points where passengers may change conveniently from the railroad to the subway. The Marble Hill cut-

*By G. R. Wadsworth, late with the New York Central.

Line of Marble Hill Cut-Off Looking South from Tunnel Portal.

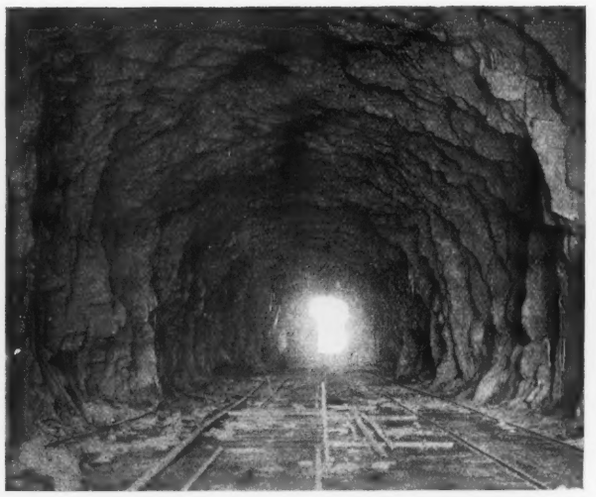


Line of Marble Hill Cut-Off Looking North Toward Tunnel Portal.

Side Hill Cutting in Rock, Marble Hill Cut-Off.

Fill Below High Bridge for Temporary Engine Terminal.

North Portal of St. Mary's Park Tunnel.



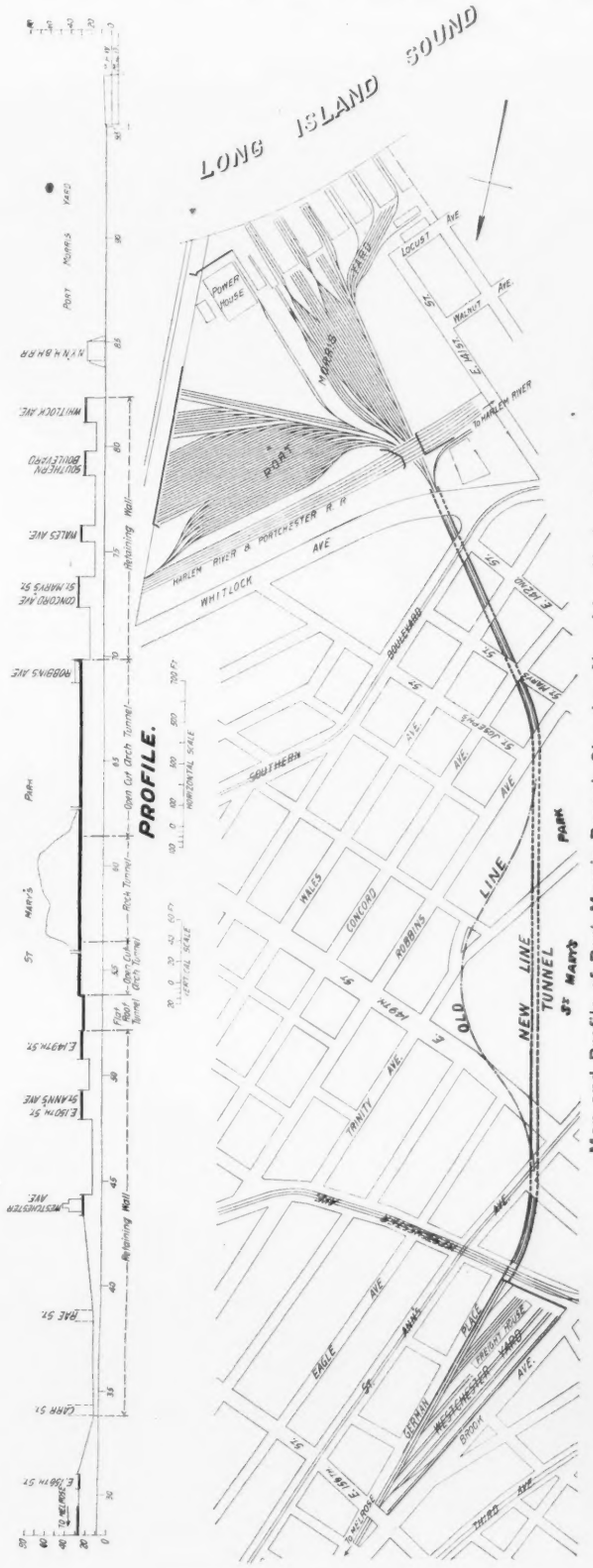
Interior of Double Track Tunnel Under St. Mary's Park.

off is now under construction, D. D. Streeter, of Chicago, contractor. The Spuyten Duyvil rectification, comprising the four-track tunnel, has not been started, but the contract has been awarded to the John Shields Construction Co., of New York.

Port Morris Branch Depression.

The Port Morris Branch extends from Melrose, about a mile east of Mott Haven on the Harlem Division south about two miles to the Port Morris docks on the East river. This branch was partially depressed in connection with the Harlem depression completed in 1890, and the balance of the depression about a mile long from Westchester avenue to Port Morris, is now under construction.

The work involves the double-tracking as well as the depression of the line, and includes the elimination of all existing street grade crossings, the streets being carried over the tracks, and also provides for the crossing of streets not now built, by constructing the necessary abutments and bridges. The alinement of the branch is changed as shown on the accompanying map, being carried in a double track tunnel under St. Mary's Park. When completed the tunnel will be about 2,000 ft. long, concrete lined throughout. Only about 500 ft. required tunnel excavation, however, the balance being open cut work.


LONG ISLAND SOUND
PROFILE.
OLD LINE
NEW LINE TUNNEL
ST MARYS PARK
HARLEM RIVER & PORTCHESTER R. R
WHITLOCK AVE
SOUTHERN BOULEVARD
Map and Profile of Port Morris Branch Showing New Line Under St. Mary's Park.

Cut and North Portal of St. Mary's Park Tunnel.

This piece of construction is not a link in the great chain of terminal improvements, it being more or less isolated, and used soleiy for freight purposes. It is mentioned, however, as having a bearing on the policy of the railroad in its consistent action to abolish all grade crossings in the vicinity of New York. Incidentally it should be mentioned that incorporated in each of the two concrete side walls of the depression is a battery of 32 single tile ducts for the electric power transmission cables from the Port Morris power house. Work on the depression has been under way for about a year. The United Engineering & Contracting Company, of New York City, contractors.

Elimination of Grade Crossings and Special Station Improvements.

Within the zone of electrification each station has been studied with a view of improving and increasing the facilities in connection with the elimination of grade crossings. Plans have already been perfected for a large majority of the stations and at some points the construction work will begin next spring. The building plans for the new stations will be prepared by the associated architects for the Grand Central Station, and the station grounds will be laid out by the landscape gardener of the railroad company.

Concrete Walled Cut in St. Mary's Park.

Between Mott Haven and Spuyten Duyvil, new overhead sta-

tions in connection with new street crossings have been designed, for High Bridge, Morris Heights and University Heights, to be used jointly with the Putnam Division. The present stations at University Heights and at Fordham Heights will be abandoned after the completion of the new University Heights station, which will be located about one block south of the present Fordham Heights station, at 184th street. This street is to be carried across the Harlem river by a bridge to connect with 207th street in Manhattan. Plans for this new bridge have been finished by the city bridge department, and the pivot pier for the draw span is already completed. Work on these three new stations and street bridges is under way, the contract having been awarded to the Snare & Triest Company, of New York.

Between Spuyten Duyvil and Yonkers new stations will be built at Riverdale and at Mt. St. Vincent, and at Ludlow the two streets crossing the tracks at either side of the present station will be merged into one overhead crossing, with a new overhead station.

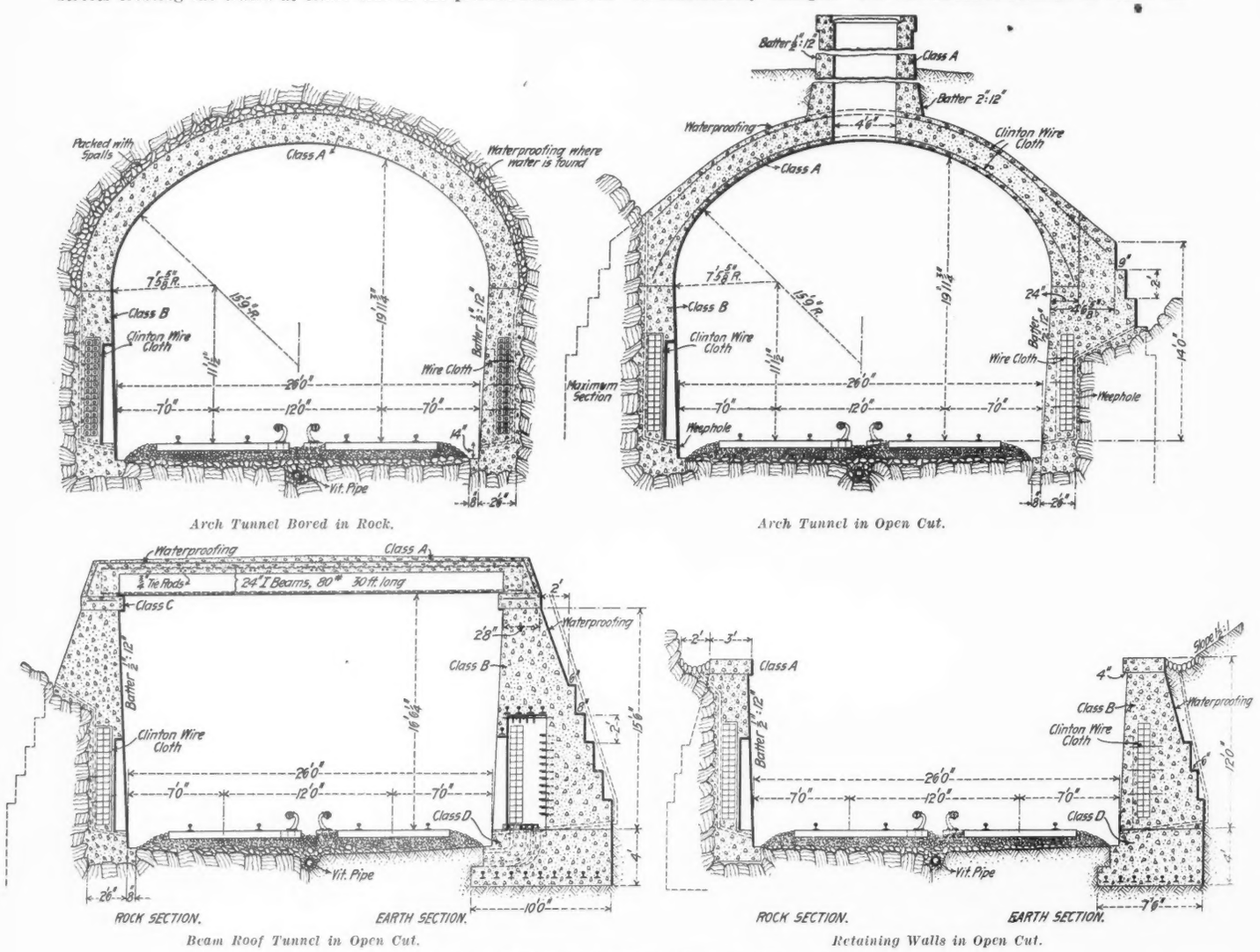
The Yonkers improvement provides for raising the tracks throughout the city, the streets in most cases being carried under the railroad, substantially at existing grades. The improvement includes a handsome new station at the street grade, access to the platforms being by stairways from the passenger concourse underneath the tracks, and by special elevators from the baggage and express subways. This improvement includes also new overhead stations at Ludlow and Glenwood. For the Yonkers local service middle tracks are provided between the main tracks for the storage of trains, and to facilitate the movements for the return trip. Besides the four main tracks a fifth or industry track will extend throughout the city for the purpose of serving local industries. Extensive additions have also been provided to the local freight facilities.

A new station has been planned for Hastings together with the elimination of grade crossings. Through Irvington and Tarrytown the grade crossings will be eliminated, and at the latter station the grade of the tracks will be raised to allow the streets to pass beneath the railroad.

Through Ossining the two existing double-track tunnels beneath the prison grounds will be widened for four tracks, center columns with flat steel concrete roof replacing the present brick arch in the longer tunnel, the shorter one to remain an open cut with retaining walls. A new station has also been planned at this point.

On the Harlem Division a new overhead street crossing together with a new overhead station has already been completed and recently put into service at 233d street, Woodlawn. Extensive improvements through Mount Vernon have been planned, involving a radical change in alinement together with the elimination of all grade crossings and a new station. Similar improvements are also contemplated for White Plains, where, too, the alinement will be considerably changed. The intermediate stations of lesser importance have received attention and improvements will be perfected at each point. Largely increased local freight facilities will be provided at many points to suit the needs of growing communities and to encourage the establishing of industries within a short distance of the New York market.

The new station layouts have all been designed for four tracks, with right hand operation in pairs, the express trains using the middle two tracks. All platforms will be of concrete. It is proposed ultimately to have the suburban trains served with high platforms, level with the car floor, similar to those in the subway; but during the period of gradual installation of the new equipment, temporary low wooden platforms will be used in the new stations first constructed. The express platforms will be low, and of the island type between the express tracks. All platforms will be connected with the passenger and baggage concourses by stairs or elevators to an overhead bridge or a subway, and no crossing of the tracks at grade will be permitted. The company has adopted the "butterfly" section type of canopy for island platforms, as being in all respects best suited to fulfill the requirements of a pleas-



Arch Tunnel Bored in Rock.

Arch Tunnel in Open Cut.

Beam Roof Tunnel in Open Cut.

Retaining Walls in Open Cut.

Typical Tunnel Sections Used in Port Morris Branch Improvement Under St. Mary's Park.

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ing and serviceable shelter. For the local side platforms shelters with cantilever supports rising from the outer edge of the platform, the rear of the platform being entirely enclosed, are being considered and may be used jointly with the "butterfly" type. The local platforms will be from 350 to 500 ft. long, and the express platforms from 600 to 1,000 ft.

The stations are classified in three types. Local, where provision is made for the landing of passengers from suburban trains only, there being an outside high platform for traffic in each direction; local express, where occasional express stops are desirable in connection with the regular local stops, effected by crossovers between express and local tracks at either side of the station, there being a low platform extension to the high platform; combination, providing for regular stops for both local and express train service.

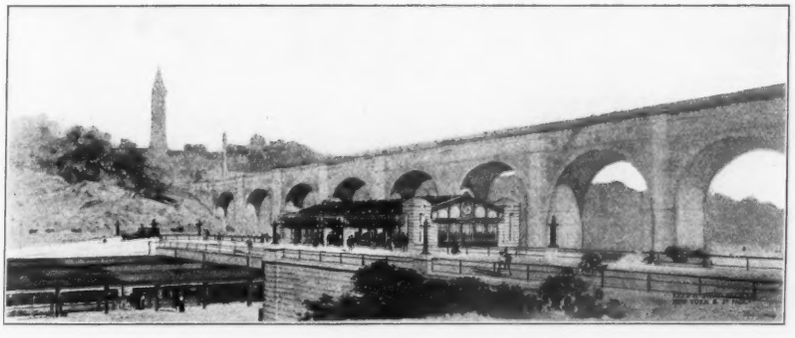
Consideration has been given to the minor features of the proposed new stations, platforms, stairways, etc., and in several instances the company has had constructed and put to actual use experimental designs before reaching a decision.

In connection with the elimination of grade crossings the masonry abutments and retaining walls will be largely of concrete, except at such points where the approaches to bridge crossings built by the municipality, may be of stone masonry, where a similar treatment will be carried out to give the proper architectural harmony.

Four-Tracking the Hudson and Harlem Divisions.

In connection with four-tracking and station improvements particular attention has been given to the rectification of alinement throughout the entire territory involved. Almost every curve has been considered with a view to its complete or partial elimination, and the consequent improvement of alinement, and at several points the work of building the new roadbed on the rectified line is now progressing. The question of eliminating curvature has been studied from a standpoint of economy in operation. Modern improvements and refinements in track and in permanent way have been many, and with the 100-lb. rail, rock ballasted track, and curves in general not exceeding 2 deg., with spiral easements, which are normal conditions on the New York Central along the Hudson river south of Croton, the question of warranted expenditure to eliminate curvature, intangible at best, resolves itself into one of judgment. Investigations as to the material underlying the bed of the Hudson river adjacent to the roadbed have been made by wash and core borings, and in several instances river mud to a depth of 50 or 60 ft. has been found. At certain points contemplated radical changes in alinement to reduce curvature were abandoned on account of the great difficulty and consequent expense involved in securing suitable foundations for the new roadbed.

The present Hudson Division is double-track from Mott Haven, where it leaves the Harlem Division, to Spuyten Duyvil, and from there north to Ossining there is a middle track between the north and southbound mains. The entire line will be four-tracked to Croton with double storage or emergency tracks between the local and express tracks, each of two 75-car trains capacity, for traffic in either direction, located at convenient operating intervals. From Spuyten Duyvil north for a distance of some three miles the two freight tracks from the west side, or city division, will be carried along the river side of the four main tracks to Ludlow, where a system of crossovers will serve to divert the freight traffic to or from the main passenger tracks.



Proposed Station at High Bridge.

The filling for the new embankment for the additional tracks along the Hudson river will be obtained largely from the excavation at the Grand Central yard. This material is more than half rock and is well adapted for filling along the river front. After the new embankment is completed a substantial sea wall of riprap will be constructed.

The Harlem Division is at present four-track to Woodlawn, where the New York, New Haven & Hartford joins. From Woodlawn north through White Plains, at present double track, two additional tracks will be constructed, making the four-track line complete to North White Plains terminal. The four-tracking involves the extension of all bridges and culverts, and in many instances complete new structures of a type appropriate for the four tracks have to be provided. When completed the roadbed structures will practically be renewed throughout.

The shorter signal blocks made necessary by the contemplated large increase in suburban train service under electric operation, will require the complete renewal of the existing block signal system. Automatic block signals will be employed. The increased track facilities also require new power interlocking plants at all the important stations. The installation of the third or contact rail will be carried on together with the new track and switch work as far as practicable.

Proposed Station at University Heights.

The Commercial Cable Company's New Atlantic Line.

The Commercial Cable Company's fifth Atlantic cable from Canso, Nova Scotia, to Waterville, Ireland, was completed and put in operation on October 6. This makes seven transatlantic cables worked in direct connection with the lines of the Postal Telegraph-Cable Company. All of them are duplexed, so that their combined capacity is fourteen messages at one time.

The new cable is the best and most expensive submarine cable ever laid. It was manufactured by the Telegraph Construction & Maintenance Company, of London, having been begun in March, 1905, and finished and shipped on board the construction company's steamer Colonia on August 3, 1905.

Atlantic cables are always laid from west to east because of the prevailing westerly winds in the summer months on the Atlantic, consequently the Colonia landed the heavy shore end of the cable at Canso on the morning of August 18. Moving out from the shore she struck a rock and was fast for four days. The injuries compelled her to go into drydock at Halifax with 2,300 miles of submarine cable board. On September 23 she laid her course from Canso, N. S., paying out cable. On September 28 she passed through a hurricane in mid-Atlantic, although on that day the weather on both sides of the Atlantic was reported fine, with gentle winds. On October 3 she arrived without mishap at a point 187 miles from the coast of Ireland, where the final splice was to be made between the cable that she had laid out from the American side and the 187 miles of cable previously laid westward from the Irish coast by the steamship Gambria in June. The weather was heavy, and the Colonia hove to until October 6, when the final splice was made.

At some points the cable was laid nearly three miles below the surface. The material used in the manufacture of the cable was 1,411,200 pounds of copper; 799,688 pounds of gutta-percha; 1,500,000 pounds of brass tape, jute yarn, iron wire and preservative compound.

The signaling speed of this cable is 15 per cent. greater than that of any other of equal length in the Atlantic. The cost varied from one thousand dollars to six thousand dollars per mile, according to the character of the ocean bed and depth of water. This variation was due to the different diameters and weights of the sections. The cable laid in the deepest water is lightest, because it would be impossible to retrieve a heavy one from the deep water. Cable in deep water is little liable to injury, and does not need to be so strong. The sections laid near shores are of massive construction and expensive. In the neighborhood of the fishing grounds off the coast of Newfoundland, a type of cable midway between the deep water and shore end cable is used. This intermediate size is made strong enough to resist injuries from the anchors of fishing craft, which is a prolific source of danger. This intermediate type is made just heavy enough to afford reasonable prospect of retrieving it in the event of its being damaged by an anchor.

Two Baldwin Four-Cylinder Balanced Compound Locomotives.

The accompanying illustrations show two new types of four-cylinder balanced compounds recently turned out by the Baldwin Locomotive Works. The Atlantic (4-4-2) type engine is one of two built for the Chicago, Rock Island & Pacific, and the Pacific (4-6-2) engine is one of an order of 28 for the Atchison, Topeka & Santa Fe.

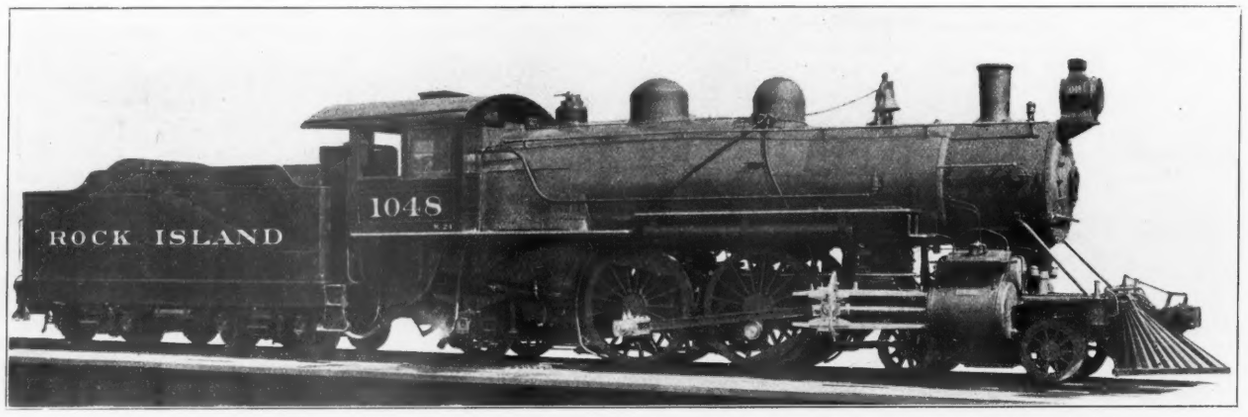
The Rock Island engines follow closely that road's standard design for simple Atlantic type locomotives prepared by the motive power committee appointed some time ago to standardize the locomotive equipment on the Rock Island System. The wheel base has been increased 2 ft. 9½ in. to permit the inside cranks to drive on the forward axle without setting the high pressure cylinders forward as in the Cole engine. The total weight has been increased 14,400 lbs. over the simple engines, but of this increase only 1,540 lbs. has been added on the drivers. Some changes have been made in the design of the boiler also, the working pressure being increased from 185 lbs. in the simple engines to 220 lbs. in the compounds. The compounds have 820 sq. ft. more heating surface and 5.4 sq. ft. more grate area. Their tractive power, however, is about the same as the simple engines, the compounds having 24,000 lbs. as against 24,700 lbs. for the simple engines. These engines will be tested on the Illinois Division in comparison with the simple Atlantic engines now in service.

The Santa Fe locomotives are the second lot of Pacific type balanced compounds turned out by the Baldwin Works, the first engine of this type having been built for the Oregon Railroad and Navigation Co. last spring and placed on exhibition at the Manhattan Beach convention of the Master Mechanics' Association last June. The Santa Fe engines have the same size cylinders, 17 in. and 28 in. x 28 in., as the O. R. & N. locomotives, but they are heavier on drivers and more powerful in every way. The inside rods are bifurcated and drive on the middle axle with the outside rods. The weight on each driving axle is 50,630 lbs., which is not so high as the weights usually applied in Atlantic type balanced compounds. They are equipped for oil burning. The following table gives some of the principal dimensions of the Santa Fe engines and the first locomotive of this type built for the O. R. & N. Co.:

	Santa Fe.	O. R. & N. Co.
Total weight	226,700 lbs.	231,300 lbs.
Weight on drivers	151,900 "	143,600 "
Grate area	.....	49.5 sq. ft.
Heating surface	3,595 sq. ft.	3,053 sq. ft.
Boiler pressure	220 lbs.	200 lbs.
Diameter of drivers	73 in.	77 in.

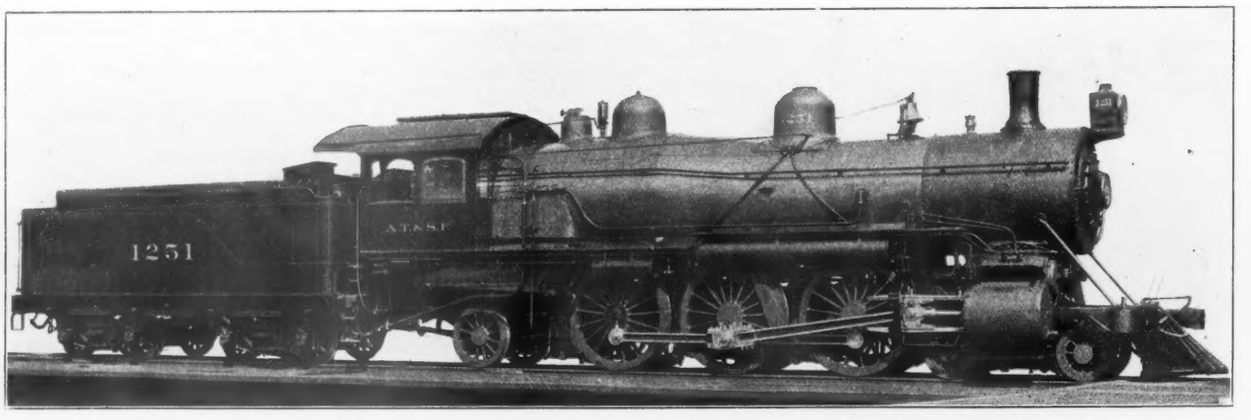
The general dimensions of the Santa Fe and the Rock Island engines are given in following table:

	Rock Island: Atlantic type.	Santa Fe; Pacific type.
Kind of fuel	Soft coal.	Oil.
Weight on drivers	105,540 lbs.	151,900 lbs.
" on forward truck	51,780 "	35,800 "
" on trailing truck	42,080 "	39,000 "
" total	199,400 "	226,700 "
" eng. and tender loaded	340,000 "	402,783 "
General Dimensions.		
Wheel base, total, of engine	30 ft. 3 in.	34 ft.
" " driving	6 " 10 "	13 ft. 8 in.
" " total, eng. & tendr	60 " 8 "	66 " 1½ in.
Heating surface, firebox	194 sq. ft.	192.8 sq. ft.
" " tubes	3,015 "	3,402.2 "
" " total	3,209 "	3,595.0 "
Grate area	50.2 "	.....



Atlantic (4-4-2) Type Four-Cylinder Balanced Compound for the Chicago, Rock Island & Pacific.

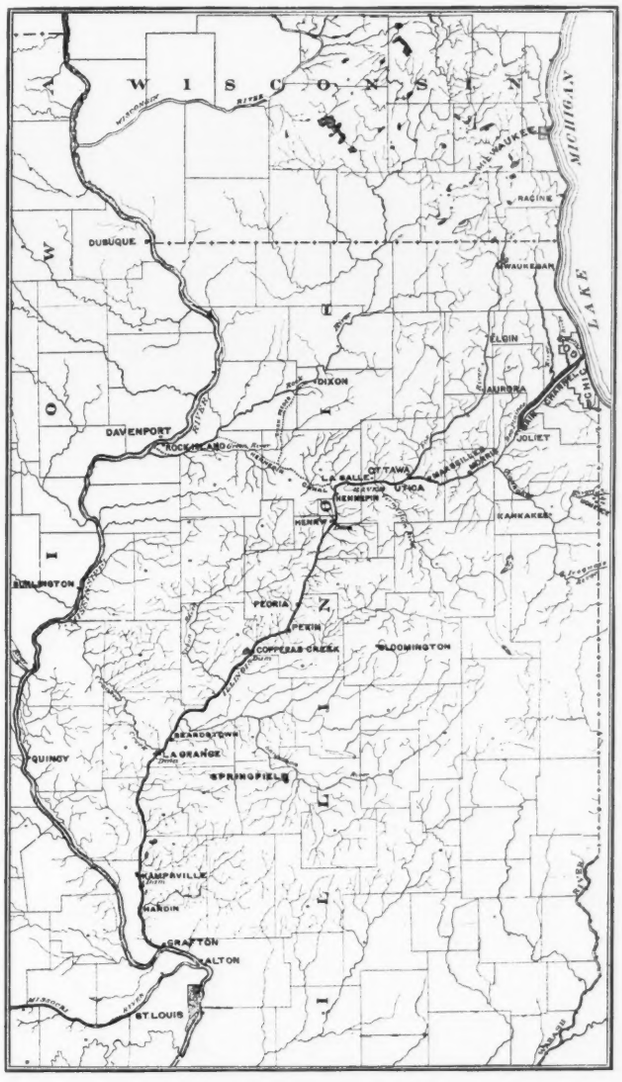
Wheels and Journals.		
Drivers, number	4	6
Drivers, diameter	73 in.	73 in.
Truck wheels, front, diameter	33½ in.	31¼ in.
Truck wheels, trailing, diameter	45 in.	43 in.
Journals, driving, main	10 x 10½ in.	11 x 10 in.
" driving, others	9 x 12 "	9 x 12 "
" front truck	6 x 12 "	6 x 10 "
" trailing truck	8 x 14 "	7½ x 12 "
Cylinders and Valves.		
Cylinders, diameter	15 in. and 25 in.	17 in. and 28 in.
Piston, stroke	26 in.	28 in.
Valves, kind of	Balanced piston.	Piston.
Boiler.		
Type of	Extended wagon top.	Wagon top.
Working steam pressure	220 lbs.	220 lbs.
Diameter of first ring	66 in.	70 in.
Thickness of sheets	$^{11}/_{16}$-in. and $^{13}/_{16}$-in.	$^{21}/_{32}$-in., $^{3}/_{4}$-in. & $^{25}/_{32}$-in.
Staying	Radial.	Radial.
Firebox.		
Length	107 $^{9}/_{16}$ in.	108 in.
Width	67¼ "	71¼ "
Thickness of sheets, crown	⅜ "	⅜ "
" " " tube	$^{9}/_{16}$ "	½ "
" " " sides	⅜ "	⅜ "
" " " back	⅜ "	⅜ "
Water space, front	4½ "	4½ "
" " sides	4½ "	5 "
" " back	4½ "	4 "
Tubes.		
Number	273	290
Material	Iron.	Iron.
Wire gage	No. 11.	No. 11.
Outside diameter	2¼ in.	2¼ in.
Length	18 ft. 10 in.	20 ft.
Tender.		
Tank capacity	7,000 gals.	8,500 gals.
Fuel capacity	12 tons coal.	3,300 gals. oil.



Oil Burning Pacific (4-6-2) Type Four-Cylinder Balanced Compound for the Atchison, Topeka & Santa Fe.

A Deep Waterway from Chicago to the Mississippi River.

As the chief feature of a vast scheme for diverting from Lake Michigan the sewage of Chicago which had hitherto been polluting the city's water supply, the Chicago Drainage Canal has world-wide fame. But while made primarily for sanitary purposes, its possibilities as a navigable channel and section of a deep waterway of considerably greater length had also a foremost place in the minds of its promoters and designers, as is indicated by its legal name of "Chicago Sanitary and Ship Canal." In order that its importance and value as a waterway may be understood fully, reference should be made to the accompanying map. As will be seen, the canal establishes a connecting link between Lake Michigan—or, more properly, the Chicago river—and natural waterways extending through the State of Illinois to confluence with the Mississippi river. These waterways, however, in their present state



The Waterways of Illinois.

do not furnish a channel depth sufficient to float the large craft requisite to the commercial success of the project, and considerable work would have to be done on them to develop a commercially profitable waterway. This, of course, requires the co-operation of the Federal government, and as a matter of fact, the government has already taken some steps in the matter, the 57th Congress having appropriated $200,000 for making surveys of the route and preparing plans and estimates. The survey has been completed and the estimate is in the hands of the Chief of Engineers of the United States Army and will probably be submitted to Congress at its next session. Shortly after the above-mentioned appropriation had been made, the Trustees of the Sanitary District of Chicago addressed a memorial to Congress urging the construction of the deep waterway and submitting a mass of information to prove the importance and feasibility of the route. Much of what follows, including the accompanying map, is taken from that document.

The canal proper begins at the west fork of the south branch of the Chicago river and extends to Lockport, a fraction over 28 miles. The lateral dimensions vary from 110 ft. at the bottom and 198 ft. at the water line, to 202 ft. at the bottom and 290 ft. at the water line. Through solid rock cuts these dimensions are 160 ft. and 162 ft. respectively. The grade of the channel is 1⅝ in. per mile through earth sections and 3¼ in. per mile through rock sections. The depth of water varies with the flow, but the minimum is 22 ft. At Lockport there is in the canal a large windage basin cut in the stone to enable large vessels to turn around. The controlling works for governing the flow of water in the canal are also located here.

The flow of water which the canal is designed to accommodate is 600,000 cu. ft. a minute. However, in its present condition it will not admit this volume in all parts without producing a current harmful to navigation. The narrowest section of the canal will carry only 300,000 cu. ft. at a current of 1¼ m.p.h. This section can readily be enlarged, however, when conditions require. The Chicago river, the flow of which was reversed by the canal, will handle at the present time little more than the present capacity of the canal, but improvements to widen and deepen it, of which approximately 60 per cent. have already been accomplished, will make possible a flow of 480,000 cu. ft., and the remaining 120,000 cu. ft. needed to yield the maximum capacity of the canal will be supplied by a large conduit along 39th street (Chicago) to the lake, forming part of the intercepting sewer system which is being built to divert from the lake to the canal the sewage of the south side of the city.

From Lockport to the southern limits of Joliet, 6½ miles, the Des Plaines river is being deepened, widened and straightened to accommodate a flow of 1,500,000 cu. ft. per minute. This provides for the maximum flow from the canal and for all possible flood waters of the Des Plaines valley. A navigable depth for large craft will not be established, however, by the work at present under way.

All bridges concerned in the construction of the canal were built or altered in conformity to the needs of navigation. The cost of the canal when all work is completed will be approximately $55,000,000. This exceeds by $18,000,000 the sum that would have been necessary to meet the needs of sanitation alone.

From Lake Michigan at Chicago to St. Louis by the proposed water route is 362 miles. Of this distance the canal has already developed 34 miles. The Mississippi river section covers 39 miles, leaving 289 miles of the Des Plaines and Illinois rivers to be improved. Figures and estimates contained in the memorial are based on a 22-ft. channel from Chicago to Lake Joliet, and a 14-ft. channel from that point to the mouth of the Illinois. The latter figure is the depth for which the canal would provide the necessary flow of water. The estimated cost from Lake Joliet to the mouth of the Illinois is $17,000,000, of which $10,000,000 is apportioned to the first 54 miles, considerably more work being necessary on this section than on the remaining 227 miles. It is interesting to know that the full flow of the canal—600,000 cu. ft. per minute—is one-half the volume of the Mississippi at Rock Island, Ill., during the low-water season. The discharge of this additional amount of water from the canal would therefore increase materially the volume of the Mississippi during a great part of the year.

The value of a waterway such as is proposed is dwelt on at length in the memorial. Aside from the commercial benefits, the national character and importance of such a waterway are pointed out. A new means of communication in the Central West would be established, also a passageway for light-draft war vessels through the heart of the continent. And while the primary commercial advantage would accrue to the interests of Chicago and St. Louis, it would permit direct navigation between Chicago and the Great Lakes on the one hand and the Mississippi river, Gulf and South American ports on the other. Also, with the opening of the Panama canal, direct communication with the Orient could be established.

Baggage charges on the German railroads by the proposed reformed passenger tariff, permitting no free baggage, are to be by zones and for units of weight amounting to 25 kilograms; that is 26 kilograms will cost twice as much as 25. Up to 25 kilometers (15½ miles) the charge will be 5 cents per unit (55 lbs.). Then for each zone 6 cents, the first ten zones being 50 kilometers (31 miles) each; zones 11 to 13 are 62 miles each, and for these the unit of weight is 110 lbs. and the charge per zone 12 cents. The 14th zone includes all distances over 800 kilometers (500 miles), with a charge of $1.19 for every 55 lbs. Thus a trunk weighing more than 110 lbs. would pay $3.57 for 500 miles or any greater distance. Second class fare for 500 miles would be $8.64, so that with such a trunk the cost of the journey would be $12.21, or at the rate of 2.44 cents per mile. Probably not one German passenger in 50 would carry so heavy a trunk, and not one in 20 more than 55 lbs., and the illustration is to show how the fares would apply to existing American traveling customs. The proposed baggage charges are lower than express charges in many cases (as for short distances), and baggage will not be forwarded unless a ticket is shown.

Kinzie Street Track Elevation of the Chicago & North-Western, Chicago.

Although there is more or less similarity in all of the Chicago track elevation work, each piece has its own special problems, making some stretches much more difficult than others. The Chicago & North-Western has nearing completion one of the largest and most interesting pieces of this work that has been done thus far. Wells street station, the principal passenger terminal of the road, is north of and just across Chicago river from the retail district of the city. It is also a short distance east of the north branch of the Chicago river. The Galena division of the road, which is one of its three double-track main lines out of the city, runs due west from Wells street station along Kinzie street. A portion of this line extending from Fortieth avenue, near the western city limits, eastward to Sacramento avenue, about two miles, was elevated several years ago. The present work is a continuation of this elevation eastward for 2.4 miles, from Kedzie avenue to Ada street, about two miles west of Wells street station.

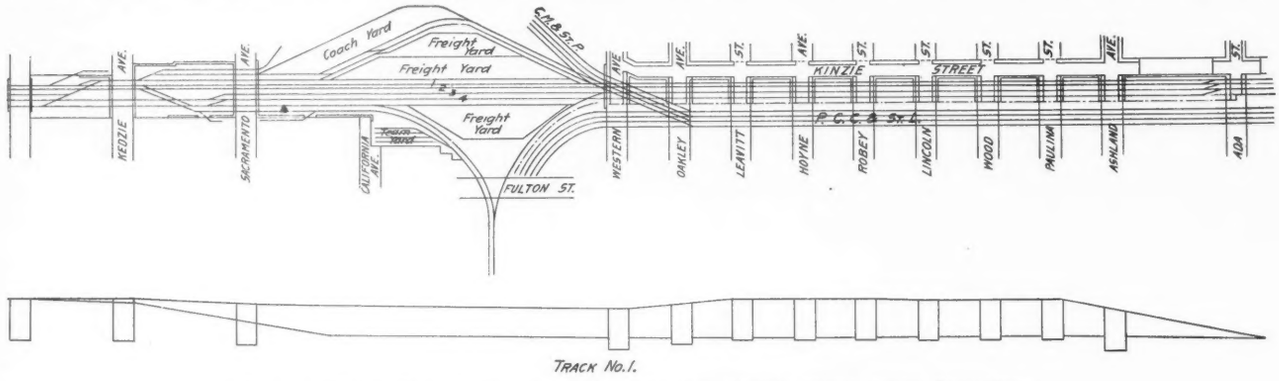


Fig. 1—Sketch Plan of Chicago & North-Western Kinzie Street Track Elevation.

The track and yard situation affecting this work will be understood by reference to the accompanying sketch plan, Fig. 1. Immediately south of the North-Western's tracks are the tracks of the Pan Handle (P. C. C. & St. L.) which come into Kinzie street from the south on Rockwell street. These tracks also are being raised, the work being only a little behind that of the North-Western. At Western avenue the Chicago, Milwaukee & St. Paul comes in from the northwest, crossing over the North-Western to join the Pan Handle tracks, which it uses into Union station. Just west of the C., M. & St. P. junction is the Western avenue freight and coach yard, which also was elevated, though not to the height of the main tracks. An idea of the situation at this point may be gained from Fig. 2. The view is looking west from Western avenue and was taken while elevation of the "north" yard was in progress. Prior to the beginning of the elevation work the main line made a detour southward to run around Western avenue yard, as seen in the photograph, and was separated from it by a high fence. This was to avoid danger from fast passenger trains running through the yards. This has been changed, the line now running directly through the freight yard, but at a considerably higher elevation, dividing it into "north" and "south" yards.

The North-Western formerly had but two main tracks on Kinzie street. It now has four as far east as Ada street, the end of the elevation work. Right-of-way for the third track, which is now the north track, was obtained from the city in exchange for paving, curbing and laying a 5-ft. sidewalk on Kinzie street between Ashland and Western avenues. The fourth or south track was obtained from the Pan Handle in exchange for the site of the old Ada street coach yard of the North-Western, which was abandoned for the coach yard at Western avenue, having double the capacity. East of Ada street there are three tracks to the north branch of the river, where there is a double-track bridge for entrance to the passenger terminal.

Work was begun in the summer of 1904 on the concrete foundations for the retaining walls and footings for the bridge abutments. By the fall of the year the retaining walls were about half built, those from Ada to Robey street being completed all but the coping. The retaining wall work was finished in the spring of the present year and all abutments were built this year. Filling was started in April, the first work being done at Western avenue yard. Filling on the line was begun in May, starting from Oakley avenue and working eastward, one track being raised at a time. The stages of the work are indicated in the cross-section of filling, Fig. 3. Before filling began the north track, which was the first raised, occupied the position indicated by the broken lines almost directly under track No. 2. Sand trains were run upon this track, the material unloaded and used to raise the track, which was lined over into the position of track No. 1 as the raising progressed. Meanwhile a pile-driver went ahead of the filling and drove the piles for temporary subway bridges for the two north tracks. One of these bridges is shown in Fig. 4 with a concrete mixing plant for the column foundations. As soon as track No. 1 was raised it was used as a working track to fill for No. 2, which meantime had been abandoned and was edged up on the side of the fill.

When the bank was ready the rail joints of the track were disconnected and the 30-ft. sections lifted to its top by a derrick car on No. 1 and quickly connected up. It was then used as a working track for the third fill and No. 1 turned over to the transportation department.

The procedure in filling for track 3 was somewhat different from the previous work. In order to avoid encroachment on the north track of the Pan Handle, whose elevation work had not proceeded so far, the track which had been acquired from that road was swung over to the right-of-way line and edged up as shown in Fig. 3 and in the photographic view, Fig. 5, to hold the bank within bounds. Track 3 is therefore a new track. No. 4 could not be put in position until the Pennsylvania had elevated its north track.

Western avenue yards contain approximately 12 miles of track. As already mentioned, these yards were not raised to the full height of the line tracks, the total elevation of which was about 13 ft. The yards were raised 6 ft. above their former grade, the relation of yard and line tracks being as shown by the cross section in Fig. 6. This drawing shows the track plan of the elevation work west of Oakley avenue. To raise the yard, one-half was abandoned and filled at a time. Alternate tracks across the yard were raised at one time, the sand cars being placed on the tracks between.

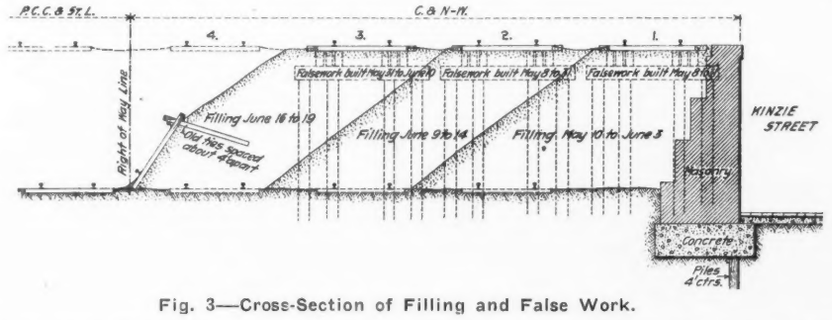


Fig. 3—Cross-Section of Filling and False Work.

In addition to what has been described, the double track from the west which swings southward on Rockwell street has been raised for about three-quarters of a mile. This track runs to Wood street freight yard and the Union Stock Yards. The interlocking plant protecting the junction of this line with the main line, which was formerly at Talman avenue, has been moved west to Kedzie avenue, and is an all-electric plant.

Raising the four-track grade crossing of the Chicago, Milwaukee & St. Paul at Western avenue was a difficult feature of the work. In order to enable this to be done most conveniently, this crossing was moved temporarily to a point east of Hoyne avenue, where the tracks were already elevated. The C., M. & St. P. used the two north tracks of the North-Western west of Hoyne avenue while the crossing was in a temporary position. As soon as the tracks had been raised at Western avenue the crossing was moved back

to its original position. This crossing will be protected by an all-electric interlocking plant.

Sand for the elevation work was obtained from Cary pit, about 38 miles northwest of Chicago on the line to St. Paul. The Track Elevation department had its own train service over this portion of the line, with special locomotives and cars assigned to it. Haskell & Barker side-dump cars were used and all sand was handled at the Chicago end by shoveling at a cost of about 5 cents a yard. The maximum amount of sand deposited in a day was 12,000 cu. yds. and the average was 7,000 yds.

The retaining walls are built of coarse rubble masonry on a foundation of concrete resting on piles. The coping is Wisconsin red sandstone, the body being gray limestone. A cross section of the wall is shown in Fig. 3, and a photographic view in Fig. 8, which was taken at Western avenue, looking east, before filling began. The concrete retaining wall of the Pan Handle appears on the south side.

The abutments for the subway bridges, of which there are nine new ones, are of dimension stone, and the sandstone is used for bridge seats. The column foundations have a concrete footing with a stone cap. The subways are all 66 ft. between abutments. The bridges, which are now being placed, are steel, and a novel floor construction is employed. Drawings are shown (Fig. 9) from which it will be seen that no longitudinal girders are used. The steelwork of the floor consists of longitudinal troughs resting on the abutments and on transverse girders riveted to the columns. The latter are built up of four Z bars riveted to a central web plate, forming an H section. The cross girders are 3 ft. 8⅛ in. back to back of angles. The troughs are 15⅝ in. wide c. to c. of web plates. They are 12¼ in. deep over angles for the sidewalk spans and 18¼ in. for the roadway spans, the lengths being respectively 11 ft. 3 in. and 24 ft. 6 in. The insides of the troughs are swabbed with hot asphalt and they are then filled with 1-3-6 concrete. Over this is laid 1⅛ in. of asphalt mastic, on top of which is a covering of 1-2-4 reinforced concrete, using ¼-in. corrugated steel bars laid 6 in. on centers. The ballast is laid on the concrete.

The floor drains from the center each way to the ends, the side gutters, formed in the floor, having a zero depth at the center of the bridge and increasing to 6 in. at each end. Drain tiles back of the abutments, under the ballast, carry off the water. At the side of the bridge is a facia girder 2 ft. 11 in. deep. These bridges are designed for a live load of two 177½-ton locomotives followed by a uniform load of 5,000 lbs. per foot of track. There is no allowance for impact because of the ballasted floor. The Pan Handle will use a similar design for its bridges, but which will, of course, be independent of those of the North-Western. The opening between the bridges at the dividing property line will be covered by reinforced concrete slabs, as shown by the detail.

Fig. 4—Temporary Timber Subway Bridge and Portable Concrete Mixing Plant for Column Foundations.

In addition to the nine new subways, the old subway at Sacramento avenue, near the west end of the work, will be revised. It was built in 1893 before any elevation work was done, and was altered in 1895 at the time the western portion of the line now being raised was elevated. It was a skew subway, there being an offset of 17 ft. in the avenue between the north and south sides of the tracks. The lowest point of its roadway was 8 ft. below its present grade. This was below the grade of the sewers and water was constantly present, although an automatic pump was installed to keep it pumped out. This subway has been straightened, a new bridge built, and the roadway raised to give the minimum subway clearance of 13 ft. To straighten the roadway, 17 ft. was acquired by the city on the east side of the street north of the right-of-way. The roadway will have two kinds of paving. On the east 20 ft. granite will be used for heavy teaming. The west 32 ft. will have brick for boulevard purposes. The two will be separated by a concrete curb which will be made of crushed granite to give greater durability. On each side of the bridge it will be 9 in. x 30 in. Under the bridge it becomes a wheel guard and a support for a row of columns. It has a foundation 6 ft. wide and 21 in. deep. The upper part is 3 ft. wide for a height of 3 ft. 8 in. and the remaining 2 ft. tapers to a top width of 1 ft. 4¾ in. Details are shown in Fig. 7. The 17 ft. on the west side, north of the tracks, which formerly was roadway, will be sodded.

Fig. 5—Track No. 4 Edged Up on Side of Fill to Protect Adjacent Tracks of P., C., C. and St. L.

Before the elevation work began there were viaducts over the tracks at Ashland and Western avenues, with truss spans of 190 ft. and 140 ft. respectively. These had to be removed by the railroad companies, which also removed the approaches. The North-Western removed the north approach to the Ashland avenue viaduct, the C., M. & St. P. the similar approach at Western avenue, and the Pan Handle the two south approaches. In addition a 250-ft. span bridge which carries the Metropolitan Elevated Railway over the tracks, had to be raised about 10 ft. This was done by jacking up the end bearings, building up the abutments, and changing the plate girder approaches, all of which was done by the Elevated Railway.

Before the work began there was a passenger station at Oakley avenue. This was abandoned and a new station is being built at Kedzie avenue. It is a one-story building with basement rooms at the street level. The general waiting room, which is at the track level, is 72 ft. x 40 ft., and there are also women's rooms and a smoking room. The material is continental brick with Bedford stone trimmings. The platforms are wood, except over the subway, where concrete is used. There is an inclined driveway of concrete leading up to the waiting room level from Carroll avenue. It opens into an area adjoining the station, also of concrete, which gives standing room for the carriages.

The estimated amount of filling material is 505,000 cu. yds. There were 4,000 yds. of first-class masonry work in the abutments, 17,000 yds. of second-class for the retaining walls, and 15,000 yds. of concrete in the work. There are about 5¼ million pounds of steel in the subway bridges. The improvement of Kinzie street required 15,000 sq. yds. of paving, 3,500 sq. yds. of cement sidewalk and 8,000 lineal feet of curb. Excavation for the sub-

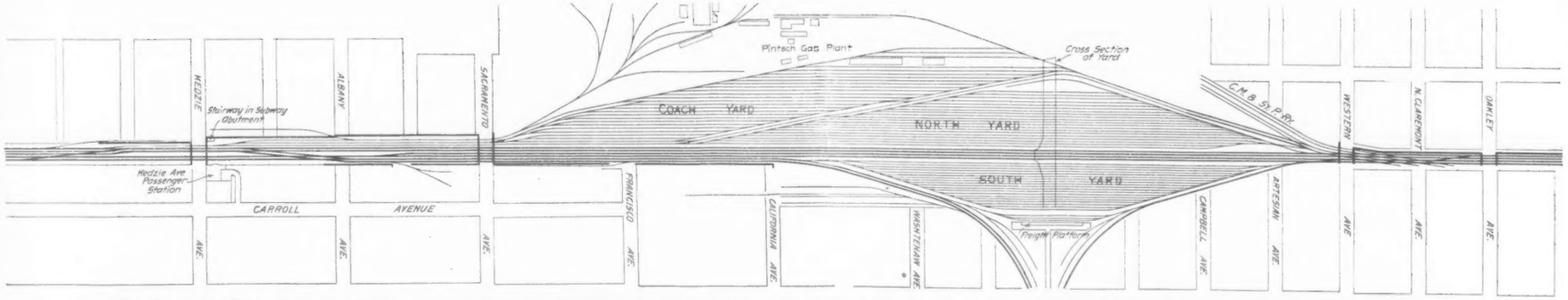


Fig. 6—Track Plan West of Oakley Avenue, Showing Western Avenue Freight and Coach Yard, C., M. & St. P. Crossing and Kedzie Avenue Passenger Station.

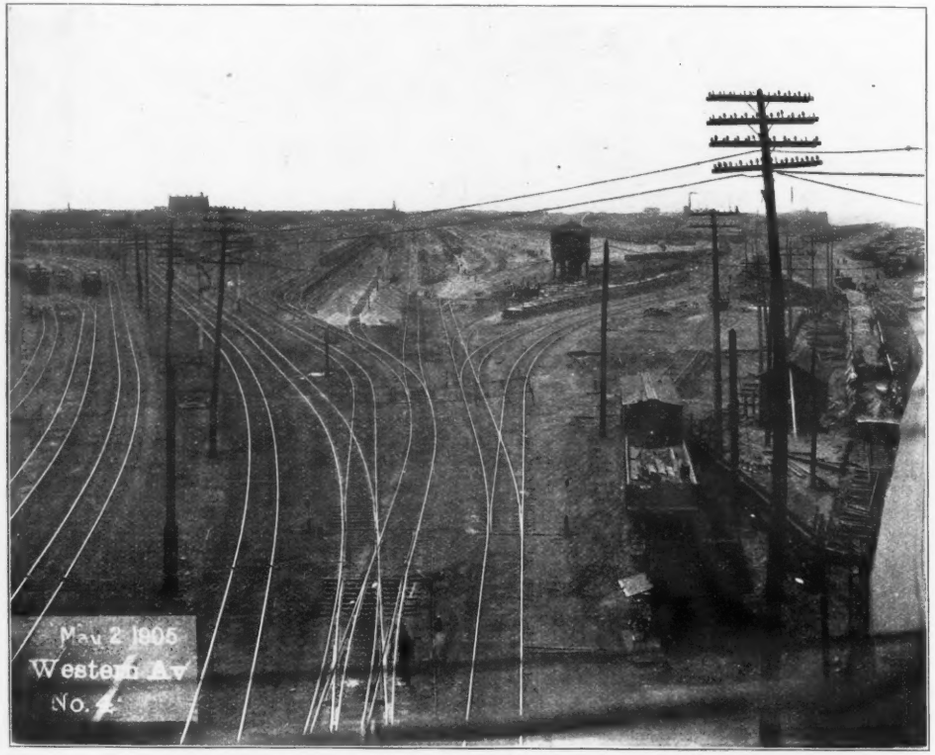


Fig. 2—Looking West from Western Avenue Before Filling Was Begun.

Fig. 8—Looking East from Western Avenue Before Filling, Showing C. & N.-W. Retaining Wall on Left and P., C., C. & St. L. Retaining Wall on Right.

ways amounted to 7,500 cu. yds. and there were 15,000 yds. of material in the north approach to the Ashland avenue viaduct. One mile of sewer was laid in Kinzie street to replace a sewer on the line of the retaining wall. It varied from 2 ft. to 4½ ft. in diameter, increasing by 6 in. every 1,000 ft. At Ashland avenue a 24-in. water main running north and south, a 12-in. east and west main and a 6-in. north and south main were all lowered about 4 ft. under pressure. East of Ada street, where the elevation work ends, the tracks are being rearranged and laid with heavier rail. Also, an interlocking plant is being put in to protect a team track yard at Green street. The estimated cost of the track elevation work, not including the Kedzie avenue station, is $1,400,000.

A very heavy traffic over this line had to be taken care of with minimum delay while the work progressed. Besides through and suburban trains, there was some freight traffic, and numerous light engine, empty train and switching movements. There was also the Western avenue crossing of the C., M. & St. P. The abandonment of Ada street coach yard required all empty passenger trains to be moved over the stretch being elevated in going to and from Western avenue yard. As the tracks were raised traffic had to be shifted from one to another, requiring constant changes in switches, signal connections, etc. Two tracks were kept open for traffic except from 10 a.m. to 4 p.m., when only one track was used, which was controlled by operators at Ada street and Western avenue respectively. While Western avenue yard was being raised a part of its work was transferred to the Fortieth avenue yard.

The entire work is being done under the direction of Mr. E. C. Carter, Chief Engineer of the Chicago & North-Western, assisted by the engineers of the track elevation department, immediately in charge of the work. Mr. J. A. Peabody, Signal Engineer, has charge of the signaling and interlocking work, and Mr. J. S. Robinson, Division Engineer, of the passenger station at Kedzie avenue. All work was done by company forces except the street improvements, and Kedzie avenue station, which were done by contract.

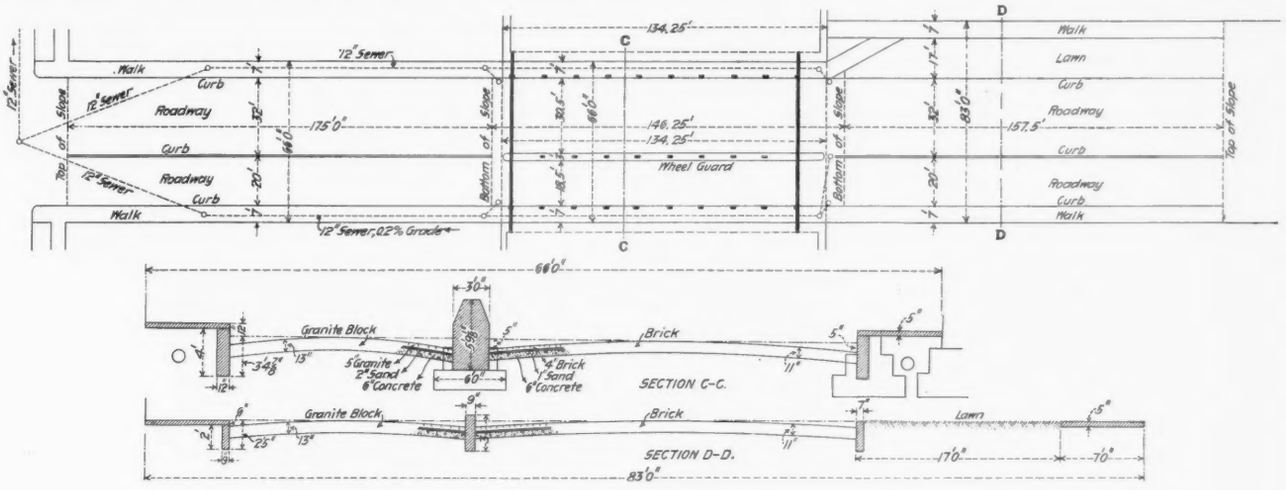


Fig. 7—Roadway Plan and Cross-Sections at Sacramento Avenue.

A very heavy traffic over this line had to be taken care of with minimum delay while the work progressed. Besides through and suburban trains, there was some freight traffic, and numerous light engine, empty train and switching movements. There was also the Western avenue crossing of the C., M. & St. P. The abandonment of Ada street coach yard required all empty passenger trains to be moved over the stretch being elevated in going to and from Western avenue yard. As the tracks were raised traffic had to be shifted from one to another, requiring constant changes in switches, signal connections, etc. Two tracks were kept open for traffic except from 10 a.m. to 4 p.m., when only one track was used, which was controlled by operators at Ada street and

Hearing on Freight Train Braking.

At Washington, November 2, the Interstate Commerce Commission heard the remonstrances of those railroads which object to an increase in the minimum percentage of cars to be controlled by power brakes in freight trains, the law at present requiring 50 per cent., and authorizing the commission to increase the minimum. The first remonstrant was the Pennsylvania Railroad. This company reports for six months an average of 75 per cent. braked in all of the freight trains run by the company; but 20 per cent. of all of the trains run had less than 70 per cent. braked and about 5 per cent. of the trains had only 50 per cent. braked. General Superintendent Creighton said that the classes of cars in which there are the fewest air-braked cars are those used in the coke and the anthracite coal traffic. These are largely old cars which it would be uneconomical to fit with air-brakes. In the anthracite region old cars have to be used because the loading facilities are not adapted to the new high-capacity cars. In the month of August the Pennsylvania ran 12,859 freight trains in which were 476,742 cars, of which 328,895 had air-brakes which were in use. This is equal to 70 per cent., or 5 per cent. less than the average for the six months reported above.

To comply with the present minimum legal requirement of 50 per cent. causes some delays, cars of coke having to be held 12 hours, sometimes, to properly make out a train. Delays like this would be made necessary in all of the yards if the minimum percentage were raised, and such delays would be especially costly at the present time on account of the great volume of traffic. The company is using every car available, and of box cars and gondolas could just now use as many more if it had them; in other words, the amount of business offering is twice as great as the company can accommodate. To take the old cars out of service for the purpose of fitting them with power brakes would temporarily deprive shippers of that much accommodation.

The Pennsylvania Lines West of Pittsburg (and, indeed, all of the large roads which appeared) made statements similar to that of the Pennsylvania. These lines own about 4,000 rack coke

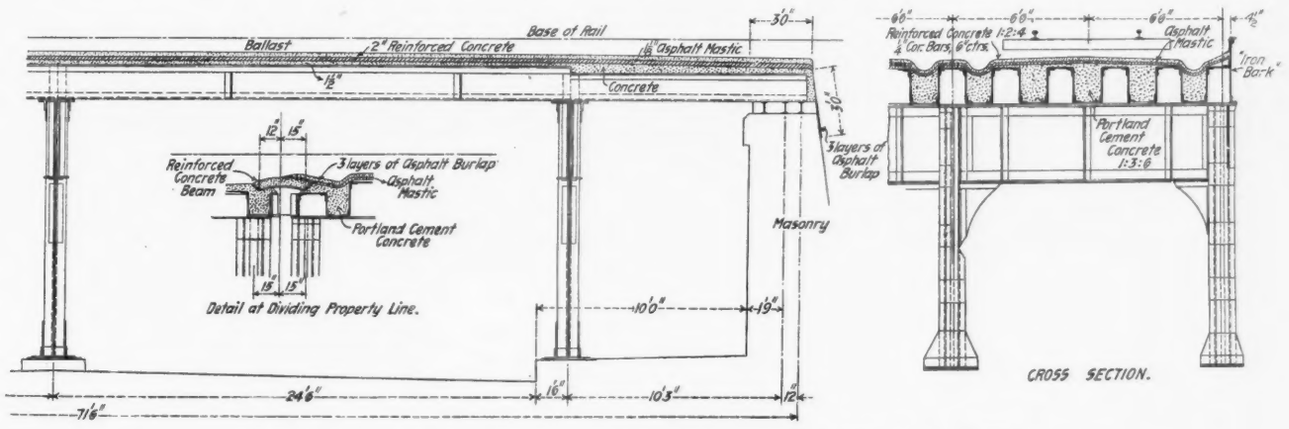


Fig. 9—Typical Solid Floor Bridge Construction on Kinzie Avenue Track Elevation.

cars, of which 45 per cent. are not equipped with air-brakes. Some of these cars are 15 years old. In applying air-brake equipment in the shops at the present time the preference is given to coke cars. Last month 350 cars were equipped in the company's shops. Asked as to the cost of equipping a car, witness (Mr. Crawford) replied that it was from $50 to $60, varying according to whether or not the three-position retaining valve was used and whether or not metal brake-beams were applied.

Mr. A. W. Gibbs, General Superintendent of Motive Power at Altoona, remarked that when they began using a larger percentage of air-brakes, the difficulties with ruptured hose increased. To show the difficulties of getting cars into the shops, Mr. Gibbs stated that his shops east of Pittsburg are now taking in 44,000 cars a week.

Mr. F. H. Clark, General Superintendent of Motive Power of the Chicago, Burlington & Quincy, told of the congestion at yards on his line, and of the difficulty of getting new cars to take the place of those old ones which are not equipped with air. The company is in the market for 2,000 coal cars, but cannot get them until late in 1906. The car shops of the country are said to have taken orders during the last 60 days for 100,000 freight cars, and railroads are asking prices now for 50,000 more. The Master Car Builders' Association has already adopted a rule that after Sept. 1, 1907, cars offered in interchange must have air-brakes; this rule will tend to hasten the application of apparatus.

General Manager Fitzgerald, of the Baltimore & Ohio, testifying to facts similar to those already given, said that of the 70,000 B. & O. cars about 30,000 were on foreign lines. A somewhat smaller number of foreign cars is on B. & O. lines. The company cannot fill half of its orders for cars for grain, coal and iron, though during the past year the movement of freight cars has been greatly improved, the average now being 33 miles a day as compared with a former average of 26 miles a day. The company has ordered 10,000 new cars, but many of them will not be delivered until next year; and the makers give good excuses for the delay. B. & O. yards are more and more crowded and it is increasingly difficult to comply with the 50 per cent. minimum rule. Replying to questions, Mr. Fitzgerald said that on the steep grades of his line, 2 per cent. and steeper, the brakemen are required to be constantly at their posts, ready to use the hand-brakes if necessary, and the retaining valves are always used. Asked why he could not control trains on descending grades wholly by air, as is done on roads in the west, he replied that some of the roads in the west—the Duluth & Iron Range, for instance—used the hand-brakes as was done on the B. & O. If one inquires of those roads, the reply is that the trains are controlled by the power brakes, but actual observation had shown otherwise.

Mr. Maher, of the Norfolk & Western, said that his company had only 1,200 cars yet to equip, but that on certain branches he had to use old cars (largely non-air) because the bridges on those branches are not strong enough for the new and heavy cars. The company is spending large sums annually renewing these bridges, but has not got the work finished. The Norfolk & Western would also be inconvenienced by lack of capacity in yards. The yards are being enlarged as fast as possible.

The Lehigh Valley has 78 per cent. of its cars equipped; but three-quarters of the cars in its trains are foreign. At Suspension Bridge, an important terminal, its switching is done in the yard of another company, so that enlargement of facilities is a difficult matter.

Mr. Seley, Mechanical Engineer of the Chicago, Rock Island & Pacific, said that his road had 80 per cent. of its cars equipped and the St. Louis & San Francisco 85 per cent.; and under normal conditions he would not object to a slight increase, but conditions are now abnormal, both by reason of the rush of traffic and by the excess of work in the shops.

Mr. L. G. Parish, Assistant Superintendent of Motive Power of the Lake Shore & Michigan Southern, said that on the main line his company could comply with a rule requiring an increased percentage, but on branches, where old cars have to be used on account of the insufficient strength of bridges, an increase would be a hardship. His company is retiring low-capacity cars because of their low capacity, and not because they are worn out.

Mr. Smith, General Superintendent of Motive Power of the Atlantic Coast Line, said that his company would have no difficulty with through trains, but on local freights and on branch lines an increase in the required percentage would be a hardship; and the increase in switching necessary to get the air-braked cars together would increase the danger to trainmen. The company has 3,325 new cars now being made. If, by reason of the air-brake rule, cars are delayed, the company is in three states obliged to pay a penalty to shippers for the delay beyond a certain limit.

Mr. J. N. Seale, Superintendent of Transportation of the Southern Railway, explained that his system is made up largely of old and weak railroads. The company has 91 per cent. of its cars equipped, but, with insufficient yards, has difficulty now in complying with the law. Yards are being enlarged as fast as the company can find contractors to do the work, and within less than two years extensive new yards will be made at Atlanta, Asheville, Knoxville, Columbia and Birmingham. In the coal district it is often necessary to delay loaded non-air cars 24 hours in order to comply with the 50 per cent. minimum rule. This is largely due to irregular loading by shippers, the cars (part air and part non-air) having to be distributed for loading at a great many comparatively small loading points. The company needs at this moment 5,000 additional freight cars. Of the penalties for delays to freight, spoken of by Mr. Smith, the Southern has $4,000 now hanging over its head. These penalties have to be paid unless the traffic department is cunning enough to "jolly" the shippers into withdrawing their claims.

Mr. C. Peter Clark, General Manager of the Buffalo & Susquehanna, spoke of the difficulties on his road. At the same time, he is compelled by self-interest, regardless of any law, to keep his braking at the highest efficiency, because of the numerous steep grades. On his grades of 148 ft. to the mile he requires the hand-brakes to be set at the top of the grade, and the engineman is compelled to haul the trains down grade. On the branches some of the grades are 172 ft. to the mile, with frequent switchbacks.

Mr. E. E. Clark, representing the brotherhoods of conductors, brakemen, enginemen and firemen, who had questioned most of the railroad witnesses, put on the stand Inspector Strickland, of the Interstate Commerce Commission, who testified that in Colorado, and elsewhere, trains have for 10 years been successfully handled on 3 per cent. and 4 per cent. grades wholly by air-brakes. The general condition of the air-brake service on the railroads east of the Mississippi river has improved of late, but the improvement has not progressed so fast as it should have done because the railroads have insufficient forces of maintainers and not enough testing plants. Some roads try to use all of the air possible, while others seem content to use just 50 per cent. He had seen many cases where, by making one more switch, the percentage of air in a train could have been materially increased. Speaking of the increased safety to be secured by increasing the percentage of air, Mr. Strickland emphasized the value of this safeguard on up grades, in cases where a train breaks in two. The hand brakes are now so inefficient that when the rear part of a train breaks away the brakemen are often unable to get the brakes applied before the cars elude control and run back.

Mr. Clark, in summing up his argument in favor of an increase in the minimum percentage, said that the brotherhoods had not asked for this hearing, but, the hearing having been appointed, they deemed it their duty to appear. For 12 long years the railroads had been preparing to comply with the spirit of the Safety Appliance law, but with repeated requests for delay and other dilatory actions. The railroads offer the same argument to-day that they made two years ago. They ought to be glad to increase the percentage of air-brakes, as they—some of them—have been able to save money by reducing the number of brakemen on trains. In some cases two men have been taken off. The only trouble arises from the old cars still in service. The plea that cars cannot be equipped cannot be accepted because the New York Air-Brake Company can supply 30,000 equipments by January 1.

An increased minimum percentage is reasonable for the reason that a number of roads have already voluntarily made such a rule. The Lackawanna requires a minimum percentage of 70 per cent.; the Philadelphia & Reading 75 per cent.; the Hocking Valley and three other roads in Ohio the same; the Seaboard Air Line the same; the Atlanta & West Point 85 per cent., and the Boston & Albany (in trains of 20 cars or more) 60 per cent. The General Manager of the Lake Shore & Michigan Southern says that on through trains he insists on all of the air being used; and the New York Central has issued an order that freight conductors shall see that all of the air cars are put ahead.

The roads now opposing the issuance of an order by the commission represent only 32 per cent. of the mileage of the country; the companies operating the other 68 per cent. evidently have no objection.

The employees in the brotherhoods are unanimous in desiring to have the object of the law accomplished as soon as is reasonably possible; but, said Mr. Clark, we will be satisfied with an order requiring 100 per cent. in every train air-braked by July 1, 1907, as has been suggested in the remarks concerning the rule adopted by the Master Car Builders' Association.

After some inquiry as to the propriety of issuing an order requiring all of the cars in a train to be air-braked, and concerning the probable time when the present congestion of freight traffic would abate, the hearing was closed.

The statistical report of the German Railroad Union for 1903 shows for all the roads in the Union average receipts of 1.003 cents per passenger mile. On the Austrian-Hungarian lines the average was 0.969 cent. Per ton per mile the average receipts were 1.280 cents on all lines, 1.276 on the German lines and 1.314 on the Austrian-Hungarian lines.

Percentages of Freight Cars Air Braked.

In connection with its inquiry as to the propriety of increasing the minimum percentage of air-brakes to be used in freight trains, the Interstate Commerce Commission has had reports made by the railroad companies showing how many of their cars are air-braked and how well the freight trains of the past six months have been air-braked; and the data thus gathered are shown in a pamphlet just issued, the substance of which is given below. The pamphlet contains reports only from those roads which own 500 or more freight cars, and the figures are given by territorial groups. The several columns of figures show:

(1) Number of cars owned.
(2) Number equipped with air brakes.
(3) Percentage of owned cars equipped.
(4) Average percentage, in each freight train, of cars equipped with air brakes (the brakes being in use) for the six months ending Sept. 1, 1905.

Some roads are not represented in the list, their reports having been late in coming in.

Name of road.	1. Freight cars owned.	2. Equipped with air brakes.	3. Percentage— Equipped.	4. Used in trains.
Group I.				
Bangor & Aroostook	3,181	3,181	100.0	....
Maine Central	5,243	5,085	96.99	95.0
Central Vermont	3,149	1,939	61.58	72.5
Rutland	2,861	2,047	71.55	60.0
Canadian Pacific	32,133	30,829	95.94	96.0
Boston & Maine	17,155	15,216	88.80	91.5
Boston & Albany	3,415	3,342	97.86	76.0
N. Y., N. H. & Hartford	16,860	16,798	99.63	....
Total for Group	83,977	78,437	....	....
Average for Group	.....	.....	93.40	....
Group II.				
New York, Phila. & Norfolk	892	892	100.0	50.0
Del., Lack. & Western	25,183	23,176	92.03	....
Philadelphia & Reading	39,288	38,860	98.91	89.39
Cumberland Valley	630	612	97.14	97.79
Western Maryland	826	783	94.79	75.0
West Virginia Central	3,128	2,538	81.14	50.0
Delaware, Susq. & Schuylkill	1,587	1,587	100.0	90.0
New York, Ontario & Western	7,280	6,199	85.15	88.0
New York Central & Hud. R.	61,505	55,655	90.49	85.0
Lehigh Valley	35,800	31,094	86.86	78.7
Central R. R. of N. J.	19,212	18,633	96.99	93.0
Buffalo, Rochester & Pittsburg	12,776	9,926	77.69	76.0
Washington Run	19,032	17,504	91.97	91.97
George's Creek & Cumberland	821	821	100.0	50.0
Erie	52,822	45,794	86.70	....
Huntingdon & Broad Top	2,583	1,485	57.49	50.0
Lehigh & Hudson River	858	543	63.29	50.0
Pittsburg, Shawmut & North'n	3,163	3,150	99.59	100.0
Montour	841	816	97.03	....
Baltimore & Ohio	70,972	59,171	83.37	....
Delaware & Hudson	13,526	12,887	95.28	70.0
Pennsylvania	129,312	116,275	89.92	75.15
Long Island	1,691	1,219	72.09	50.0
Union	1,100	1,100	100.0	60.0
Silver Lake	620	229	36.94	65.0
Buffalo & Susquehanna	1,971	1,763	89.45	70.0
Total for Group	507,419	452,712	....	....
Average for Group	.....	.....	89.22	....
Group III.				
Pittsburg & Lake Erie	13,272	12,984	97.82	50.0
Baltimore & Ohio Southwest'n	10,580	7,385	69.80	50.0
Hocking Valley	14,272	10,431	73.09	50.0
Cleve., Cin., Chic. & St. L.	22,184	18,500	83.39	50.0
Zanesville & Western	1,400	770	55.0	50.0
Toledo & Ohio	6,396	4,354	68.07	50.0
Grand Rapids & Indiana	3,247	2,595	79.92	....
Cincinnati, Ham. & Dayton	14,078	10,937	77.69	75.0
Chicago, Cin. & Louisville	587	578	98.47	75.0
Detroit & Mackinac	1,600	1,424	89.0	50.0
Wheeling & Lake Erie	12,983	10,954	84.37	50.0
Southern Indiana	6,122	6,122	100.0	95.0
Bessemer & Lake Erie	9,813	9,807	99.94	60.0
Cincinnati Northern	2,048	1,512	73.83	....
New York, Chicago & St. Louis	8,424	4,640	55.08	84.9
Toledo, St. Louis & Western	2,891	1,430	49.46	65.0
Evansville & Terre Haute	5,132	3,927	76.52	50.0
Michigan Central	14,888	13,501	90.68	85.0
Pennsylvania, West of Pittsb'g	71,786	56,205	78.30	72.4
Ann Arbor	2,215	1,529	69.03	....
Lake Shore & Mich. Southern	26,815	25,954	96.79	77.43
Lake Erie & Western	4,737	4,457	94.09	59.83
Indiana, Illinois & Iowa	1,167	743	63.67	83.96
Lake Erie, Alliance & Wheeling	860	838	97.44	88.93
Pere Marquette	17,775	14,073	79.18	60.0
Total for Group	275,272	225,649	....	....
Average for Group	.....	.....	81.97	....
Group IV.				
Virginia & Southwestern	1,291	1,280	99.15	94.0
Kanawha & Michigan	4,168	3,901	93.59	50.0
Charleston & Western Carolina	909	837	92.08	80.0
Norfolk & Western	27,817	21,322	76.32	79.0
Chesapeake & Ohio	24,814	20,793	81.79	80.0
Norfolk & Southern	645	461	71.47	63.0
Coal & Coke	1,364	1,340	98.24	....
Total for Group	61,008	49,934	....	....
Average for Group	.....	.....	81.86	....
Group V.				
Lexington & Eastern	569	545	95.78	75.0
Nashville, Chatt. & St. L.	7,635	7,609	99.66	98.0
Georgia Southern & Florida	2,632	2,630	99.92	95.0
Georgia	1,677	1,573	93.80	93.75
New Orleans & Northeastern	2,381	2,381	100.0	....
Alabama & Vicksburg	1,039	1,034	99.52	....
Gulf & Ship Island	1,084	1,084	100.0	95.0
Florida East Coast	897	897	100.0	100.0
Atlantic Coast Line	15,877	13,809	86.97	50.0
Mobile & Ohio	8,096	6,923	85.51	73.0
Atlanta & West Point	1,103	1,103	100.0	80.0
Atlantic & Birmingham	1,316	1,216	92.40	93.0
Central of Georgia	7,971	7,598	95.32	89.29
Mobile, Jackson & Kansas City	1,014	1,005	99.11	75.0
Seaboard Air Line	10,307	9,670	93.82	95.0
Birmingham Southern	614	....	....	60.0
Louisville, Henderson & St. L.	615	408	66.34	75.0
Louisville & Nashville	33,241	30,850	92.81	81.78
Southern	42,668	38,812	90.96	....
Alabama Great Southern	4,823	4,643	96.27	91.0
Cincinnati, New Orleans & Tex	8,503	7,580	89.14	85.0
Total for Group	154,062	141,370	....	....
Average for Group	.....	.....	91.76	....
Group VI.				
Duluth & Iron Range	4,423	4,423	100.0	100.0
Duluth, Missabe & Northern	4,674	4,674	100.0	100.0
Minneapolis, St. P. & S. S. M.	10,463	8,627	82.45	80.0
Toledo, Peoria & Western	1,665	1,519	91.23	....
Chicago & North-Western	52,489	47,530	90.55	93.5
St. Louis, Troy & Eastern	856	845	98.71	25.0
Wabash	18,680	16,219	86.83	55.0
Chicago & Alton	9,272	6,865	74.04	80.0
Chicago, Peoria & St. Louis	2,968	2,211	74.50	50.0
Litchfield & Madison	1,202	970	80.70	50.0
Chic., Lake Shore & Eastern	4,284	3,392	79.18	75.0
Elgin, Joliet & Eastern	2,514	2,453	97.57	75.0
Iowa Central	3,087	3,047	98.70	50.0
Duluth, So. Shore & Atlantic	2,768	1,806	65.25	50.0
Mineral Range	559	528	94.45	50.0
Chic., Mil. & St. Paul	42,176	35,845	84.99	77.0
Wisconsin & Michigan	504	93	18.45	84.0
Green Bay and Western	567	567	100.0	90.0
Chicago & Eastern Illinois	16,237	12,224	75.29	70.0
Chic., St. Paul, Minn., & O.	11,744	10,105	86.04	75.0
Great Northern	30,876	30,876	100.0	100.0
Chicago Great Western	9,676	7,970	82.37	75.0
Chicago Junction	620	577	93.07	55.0
Wisconsin Central	8,627	8,132	94.26	93.0
Chicago, Burl. & Quincy	46,311	37,582	81.15	83.0
Lake Superior & Ishpeming	911	911	100.0	99.5
Quincy, Omaha & Kansas City	846	802	94.80	70.0
Northern Pacific	35,137	34,356	97.78	97.6
Illinois Central	59,862	53,418	89.23	62.0
Total for Group	383,998	338,567	....	....
Average for Group	.....	.....	88.17	....
Group VII.				
St. Joseph & Grand Island	1,071	1,071	100.0	95.0
Butte, Anaconda & Pacific	541	541	100.0	100.0
Union Pacific	15,059	15,059	100.0	90.0
Total for Group	16,671	16,671	....	....
Average for Group	.....	.....	100.0	....
Group VIII.				
Missouri, Kansas & Texas	15,648	14,960	95.60	....
Atchison, Topeka & Santa Fe	34,466	34,232	99.32	90.0
St. Louis & San Francisco	25,260	21,585	85.45	75.0
Colorado & Southern	6,592	6,500	98.60	98.59
Miss. River & Bonne Terre	903	903	100.0	90.0
Missouri Pacific	42,505	30,841	72.56	50.0
Fort Smith & Western	1,019	1,019	100.0	99.0
Colorado Midland	1,719	1,719	100.0	100.0
St. Louis Southwestern	10,455	8,558	81.86	91.2
Kansas City Southern	6,383	6,383	100.0	90.0
Denver & Rio Grande	12,898	12,898	100.0	97.0
Vandalia	6,788	5,725	84.34	60.0
Total for Group	164,636	145,323	....	....
Average for Group	.....	.....	88.27	....
Group IX.				
Texas & Pacific	9,118	9,118	100.0	90.0
Pecos Valley Lines	690	690	100.0	99.50
Louisiana & Arkansas	719	704	97.91	80.0
Chicago, Rock Island & Gulf	1,587	1,587	100.0	80.0
San Antonio & Aransas Pass	1,862	1,862	100.0	99.50
Vicksburg, Shreveport & Pac.	982	982	100.0	....
International & Gt. Northern	3,889	3,889	100.0	85.0
Galv., Harrisbg & San Antonio	17,568	15,704	89.39	81.0
Fort Worth & Denver City	1,050	1,050	100.0	95.0
Total for Group	37,465	35,586	....	....
Average for Group	.....	.....	94.98	....
Group X.				
Santa Fe, Prescott & Phoenix	595	595	100.0	100.0
Southern Pacific	26,309	25,698	97.68	95.0
California Northwestern	664	664	100.0	100.0
San Pedro, Los Ang. & Salt L.	2,700	2,680	99.26	100.0
Oregon R. R. & Navigatn Co.	2,481	2,030	81.82	90.0
Oregon Short Line	6,223	6,182	99.34	99.99
El Paso & Southwestern	1,236	1,236	100.0	99.68
Total for Group	40,208	39,085	....	....
Average for Group	.....	.....	97.21	....

Summary of Foregoing Table.

	Freight cars owned.	Equipped with air brakes.	Per cent.
Group I.	83,977	78,437	93.40
Group II.	507,419	452,712	89.22
Group III.	275,272	225,649	81.97
Group IV.	61,008	49,934	81.86
Group V.	154,062	141,370	91.76
Group VI.	383,998	338,567	88.17
Group VII.	16,671	16,671	100.0
Group VIII.	164,636	145,323	88.27
Group IX.	37,465	35,586	94.98
Group X.	40,208	39,085	97.21
Total United States	1,724,716	1,523,334	88.33

Summary of All Roads Replying, including Small Roads Not Shown Above.

	No. of freight cars owned.	No. equipped with air brakes.	Percentage equipped with air brakes.
Group I.	85,219	79,438	93.22
Group II.	510,725	454,533	89.0
Group III.	278,463	228,255	81.97
Group IV.	62,294	50,881	81.68
Group V.	155,692	142,670	91.64
Group VI.	389,091	341,930	87.88
Group VII.	17,371	17,370	99.99
Group VIII.	167,232	147,839	88.41
Group IX.	39,666	37,476	94.48
Group X.	44,835	40,983	91.41
Total United States	1,750,588	1,541,375	88.05

NOTE.—It has been stated that there are about 50,000 private cars in the United States, but it is impossible to obtain accurate information on this point. The private cars, however, are practically all equipped with air brakes.

Handling Freight so as to Avoid Losses.*

I cannot impress upon you too strongly the importance of exercising great care in the selection of your assistants in the office, as well as outside; also in educating them to perform their duties in a manner which will reflect credit upon themselves and your management. No matter how competent you may be, how thoroughly familiar with all that pertains to your station, or how ambitious for record, the employment of careless or incompetent clerks or warehousemen will easily defeat your purposes. It is one thing to know how to do the work yourself, but quite another thing to see that others do it as well, and the larger your forces the greater the need of care in this direction.

The agent of most value to the company is not the one who can handle the greatest tonnage at the least expense, and in so doing load it in disorder causing damage and necessitating re-handling elsewhere, or into wrong cars causing loss or delay, but it is the one who can at reasonable expense handle it in such manner that it will reach destination in order without unnecessary transfers or delay. It is entirely safe to say that a very large proportion of the freight which is lost and subsequently paid for is chargeable to loading in wrong cars, accepting and forwarding it when improperly marked, delivering it to wrong consignees, or delivering it without proper authority when astray. It can also be said that of the damages to freight, which have increased so enormously during the past few years, fully one-half could have been prevented if greater care were given in the handling it receives at stations.

A committee, consisting of the General Freight Agents of the New York Central System of roads, men of large practical experience, is at present engaged in revising and improving the rules, that you may, if possible, be better able to meet the old as well as new conditions with the latest and most approved methods of conducting your work.

You would be surprised to know how frequently the claim department is called upon to pay for goods which were consigned to the shipper's order, but which the agent at destination delivered without first securing the endorsed bill of lading. The rules to agents in respect to the delivery of order consignments are very clear on this point, but when the party notified says "I'll send the bill of lading down to-morrow," the agent says "I guess he's all right," and delivers the goods. Later on he explains at much length how he came to disregard the rule. He does not admit ignorance of the rule, but must be either that or disregard of it. . . . Nor should inspection be allowed to any person other than upon the written authority of the party to whose order it is consigned, or upon the presentation of the bill of lading, and in the latter case you should endorse on the waybill the date, and to whom inspection was allowed, for use in case any question respecting the inspection should subsequently arise.

One recent claim was for several hundred dollars for liquid blacking which was frozen because shipped in cold weather and not put into a frost proof car. It is the small errors and oversights which make up the most of the enormous total of losses. The remedy is in the hands of the agents. Prompt settlement of claims is important, but the consignee wants his goods in due season and in good order; he does not want explanations of delays or even reimbursement for delays or damages; he wants the delays and damages prevented.

Where a consignee refuses goods and they are returned it is important to have the packages re-marked; goods returned with the original marks are sometimes delayed because of difficulty in identifying them, and a delay frequently means a bill for damage.

A valuable piece of marble was marked with a receiving station rubber stamp; the ink penetrated the marble and ruined it for the purpose intended. Ink and brush were used to stencil a burlaped bale of cloth, resulting in the ruin of part of the cloth. A label was nailed on a box, the nails being an inch or more in length ruined a valuable set of books.

Take a firm stand. Personally know how the detail work of your station is conducted, what mistakes occur and who is responsible for them. Train your men in their duties, and see to it that you have the right kind and number of men. Insist upon their careful observance of the rules, and require that a genuine interest be taken in all that affects our employer's affairs. Make frequent inspections of your station and be as familiar with outside conditions as you are of the inside. Do not give all your time to the office. When you receive letters or circulars of instructions, copies of such portion of them as relate to the different branches of your work should be placed in the hands of those of your force who are in immediate charge of the matters to which the instructions refer. If you will adopt this rule and see that they understand the instructions correctly, you will have more time for supervision, and secure more intelligent service from your assistants.

*Extracts from an address on Loss and Damage and its effects upon railroad revenue, delivered to the freight agents of the New York Central & Hudson River, by R. L. Calkins, Freight Claim Agent.

Not long ago we received a check to refund a payment we had made for a lost case of goods, which one of our stations had given a receipt for and apparently forwarded. The shipper subsequently found that the case had never been taken from his warehouse. It is a pleasure to deal with men of such integrity, but it is decidedly unpleasant to know that such occurrences are possible, even at the smallest of our stations, yet such cases too often occur at stations where traffic is heavy and careless receiving clerks are employed. The position of a receiving and delivery clerk is a very important and responsible one, and should always be so regarded by the agent. In delivering goods to consignee never trust him or his truckman to do the checking, no matter how well you may know him. We paid recently for 10 bales of cotton because the consignee was allowed to do the checking. Subsequently, the cotton was found by an agent of the road, in the consignee's warehouse, while looking for other cotton.

An exceedingly perplexing and expensive case is that of a government shipment of a 65-ton cannon, which recently fell from two cars while passing over our River division, and rolled down an embankment. It has thus far resisted our every effort at re-loading, and may require a specially built track before it can be recovered. This accident, which narrowly escaped wrecking an entire train, was directly attributable to loading cars far beyond their capacity, the expense attending the recovery of the gun, as well as the damage it has doubtless sustained, is the result of a single act of thoughtlessness. Had cars of sufficient carrying capacity been used, or the gun not accepted until equipment which could transport it safely was available, the accident, with its expensive consequences, would not have occurred.

Shipments of this character only differ in point of importance from the usual cases of damages resulting from the use of defective cars for loading flour, dry goods, etc. The excuse generally offered in such cases, "The car was apparently all right," or it was the best or only car we had, does not remedy the damage, nor does it assure us that greater care will be exercised in the future. It would be far better to delay the freight until suitable cars were obtained than to take the chances of injuring it by forwarding it in cars which have floors saturated with oil or acids or defective doors or roofs, etc.

In a wreck, which occurred recently, a valuable electrical machine destined to the Pacific Coast was badly damaged. It was reloaded and sent forward, but fortunately for all concerned it was stopped and returned to the manufacturers for repairs. Had it gone to destination it would have been refused by the consignee, and either returned or disposed of at a great sacrifice and loss to the railroad company. In either case the consignee's business would undoubtedly have been injured through delay in securing a new machine, whereas returning it from the wreck to the shippers for repairs caused but slight detention and expense.

In another case a car of furniture destined to a southern point was damaged by wreck, and before we had opportunity to make an inspection it was sent forward. On arrival at destination it was promptly refused by the consignee, and subsequently disposed of by the delivering line for less than the transportation charges. Had it been returned to the shippers much of the furniture could have been restored.

A carload of potatoes was recently refused by consignee at one of our principal stations. The shipper was duly notified of the refusal but neglected to send instructions for its disposal. The agent neglected to report the case to my office, or to send a second notice to the shipper; also failed to take any action to prevent the property from becoming valueless. To this carelessness the entire loss of the shipment is due. Regardless of the apparent lack of interest on the part of the shipper, or what his intentions may have been in permitting the potatoes to remain on our hands, it was the agent's duty to save the company from loss, first, by telegraphing the shipper requesting that immediate disposition be given; second, by requesting my assistance, and lastly, by placing them with some reputable dealer who would handle them as his own. There is never any reasonable excuse for allowing property to become worthless while awaiting disposal by shipper or consignee.

We once paid a claim of $500 for some lost goods, and subsequently found them; also found that they were not worth $5. We also have several claims for alleged shortages, which were made on the strength of errors in waybilling a greater quantity than shipped. Fortunately, however, the bills of lading, which specified the quantity shipped, prevented their payment.

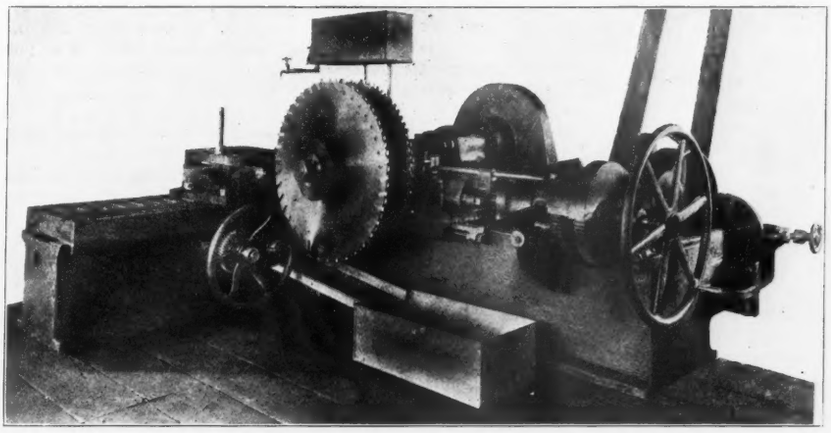
During the past few months shortages of a certain class of goods have been continuously reported at one of our stations. In each instance the full consignment appears to have been loaded at the shipping point, and the cars reached destination under the initial seals. As these shipments originated at different points the natural conclusion is that the shortages occur at the destination station. Whenever you discover shortages under these conditions make your investigations as though you were convinced that the wrong was at your station, and if you are then unable to account for it do not delay in making a special report to me, for we may have in-

formation which will aid in locating it, if not, our special officers will take it in hand. Don't keep these matters to yourselves because they may reflect on your stations.

It is a daily occurrence for me to receive from some of our agents claims which have not been given any attention to whatever; they have been simply enclosed to me as they were received from claimants. They not only omit to secure and attach such documents as the bills of lading, paid freight bills, invoices, etc., but no mention is made of the report or previous correspondence which may have been had on the subject. Over, short and damage reports are the basis of nearly all loss and damage claims, and the more information they contain the less will be the excuse for returning them for the purpose of asking you a lot of questions when the claims are received. It is urged that more care be taken in the preparation of such reports as are lible to result in claims, and that they be placed before you for personal examination and signature. This plan would have the double advantage of acquainting you with the cases in which your station is interested or involved and enable you to see that reports are so made that it will be unnecessary to return them for information which you had at the time, but which is later forgotten, or not at hand.

Much care should be exercised in the delivery of overages, which are received on astray waybills. Such freight should never be delivered until full and satisfactory proof of its ownership has been presented by the parties to whom it is marked, and then only after satisfying yourselves that a claim has not been presented, or paid for its value. When making such deliveries full charges should be collected, and the regular waybill invariably located.

Keep your unpaid bills account clear of outstandings on refused and unclaimed freight by regularly reporting these cases, as required by the rules, and whenever the disposition of such freight is unreasonably delayed make a special report by letter and more special attention will be given it.

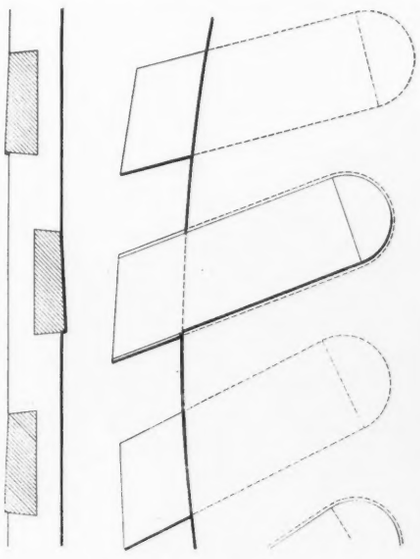


Double Rotary Slotting Machine.

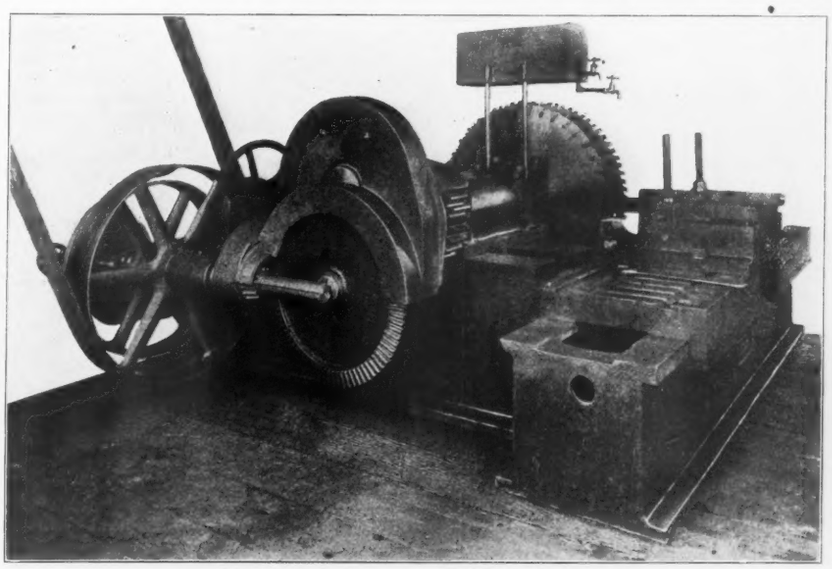
Double Rotary Slotting Machine.

The application of the rotary or milling machine principle to slotting is shown in the accompanying illustrations of a double rotary slotting machine made by the High Duty Saw & Tool Co., of Eddystone, Pa., for the Paterson, N. J., plant of the American Locomotive Company. Primarily it is intended to slot out the open ends of locomotive connecting rods, straps for the same, the jaws of eccentric rods and cross heads. The machine, however, is not confined to this special class of work but it is applicable to all classes of slotting either single or double within the range of the capacity of the machine. It can also be used as a cutting-off machine, in which case a single saw only is used. The principle of the machine is that of a continuous cut in place of the intermittent stroke of the ordinary slotting machine. The cutting heads are "Tindel" high duty saws with inserted high-speed steel cutters. Each of these cutter blades is 36 in. diameter by ⅜ in. thick, with 76 teeth or cutters in each blade. The periphery speed of the cutters is about 50 f.p.m. with feeds ranging from ½ in. to 1¼ in. per minute. The machine is of massive construction for heavy work and the main drive, as shown, is by spur and bevel gears instead of the usual worm and worm-wheel. The carriage carrying the saw arbor is square locked in front and tapered on the back side, all wear being taken up with phosphor bronze shoes. The arbor is a high carbon steel forging of large diameter and has a long bearing. The feed is by rolling friction discs through a system of change gearing for changing the rates of feed and is provided with an automatic, adjustable and positive throw-out. Washers are provided for varying the distances between the saws for cutting different sizes of slots. The sizes of these washers are so varied that with a few the width of slot can be made up to 12 in. The inward feed of the machine can be made to any desired depth up to the capacity of the saw blades. The machine is equipped with two tables which are adjustable to work separately or together. By means of gearing below the tables any setting of work to the line can be done by a hand-wheel which is shown in front of the machine. The tables are furnished with "V" blocks, straps and bolts for convenient fastening of the work. By the use of this machine it is claimed that slotting work of the character indicated can be accomplished with a saving of time amounting to about 75 per cent. as against the ordinary type of slotting machine.

The "Tindell" high duty saws used on this machine are made up to a diameter of 90 in. The blade is a disc of high-carbon crucible steel, and is of sufficient stiffness to withstand any pressure that can be safely put upon the teeth. In each face, as shown in the accompanying illustration, there are slots for the teeth. These are inclined backward from radial lines at such an angle that the pressure on the teeth when cutting has a locking effect; as the resultant of the pressure tends to force the teeth inward, and as there is no tendency to draw them by the cut, the teeth do not



Detail of the Tindell Saw



Double Rotary Slotting Machine Showing Main-Drive.

require to be pinned or bolted or otherwise fastened in place. The teeth are of simple design forged from the bar stock in a plain die. As no machine work is required to shape or fit them, the teeth can be made of the modern high-speed steels. It will be seen also that this saw has the special feature of dividing the cut, the teeth being staggered on each side of the blade and slightly overlapped, so that each tooth alternately takes half the width of the cut. The teeth have a slight outward inclination, so as to make the cut clear the saw blade, the points of the teeth being the only part of the saw which touch the work. A broken tooth can be quickly driven out by a chisel inserted in the semi-circular recess at the bottom of the slot, and a new tooth at once put in its place.

The Cost of Locomotive Operation.

XV.

BY GEORGE R. HENDERSON.

(*Continued from page* 423.)

CONSTRUCTIVE MILEAGE.

This term is usually applied to mileage which the engineman does not actually make, but for which he is paid. As we have seen from the schedule, the engineman is ordinarily paid for 100 miles, even if his run should be only 70 or 80 miles; the amount for which he is paid and which he does not make, is thus a type of constructive mileage, and is strictly unremunerative, as far as the railroad company is concerned. By careful management and adjustment of runs, such mileage can be reduced to a minimum, but it requires continuous watching.

There is another kind of constructive mileage, however, which cannot be reduced, and this is the allowance of a greater mileage in the pay than actually exists between the points. For instance, terminals A and B may be 130 miles apart, but the run may be counted as 150 miles and paid for on this basis. This will be understood as actually raising the rate of pay for such portions of the road, and it usually applies to heavy grades or difficult parts of road, where the engine works harder if the men do not. On large systems, it is sometimes considered desirable to have a standard rate of pay per 100 miles, and the method of constructive mileage allows a higher rate to be paid on certain designated parts of the road.

As an example of constructive mileage, we give below the actual distances and the allowed distances on one of the Western lines:

		Mileage—	
		Actual.	Constructive.
Section	1	92	100
"	2	115	129
"	3	143	159
"	4	23	29
"	5	28	30
"	6	51	59
"	7	149	153
"	8	167	170
"	9	69	77
"	10	46	53
"	11	23	24
"	12	82	100
"	13	50	51

It will be seen that this plays an important part in the cost of transportation. It sometimes occurs that hills must be doubled, that is, the train is heavier than can be taken up by the engine in one train, so it is cut in two—part is taken to the top and the engine then returns to the foot of the grade and brings up the remainder, when they are again united and taken to destination. This may occur because the engine has been overloaded, or because it is not in prime condition and cannot haul the regular load, or again, the profile of the division may be such as to make this an economical proceeding. The writer has in mind a division with easy grades, except at one point, where there was a heavy grade for a few miles. The traffic did not warrant maintaining helpers at this point, so the hill was doubled regularly. It is generally customary to pay for the mileage, which in a case of this kind is really run, and if the hill were five miles long there would be ten miles added to the actual length of the division for such a trip. A southern road contains this clause in its rules: "If at any time engines are unable to handle their rating, and have to double, they will be allowed ten miles for each double, unless this distance is exceeded, when actual mileage will be allowed. Another road allows one hour's time at hourly rates for each double, provided the doubling is not attributable to any fault of the engineman. It will be seen from this that there are different methods in vogue for settling these various points in the several sections of this country, but in all cases the effect is to increase the cost of operation per ton-mile, with apparently no return to the company.

LIGHT ENGINE MILEAGE.

It frequently happens that, owing to an excess of traffic in one direction, or heavier grades going one way, that the power becomes congested at one end of a division, and empty engines must be sent back to the other end, where there is a greater demand for them. This is a costly and unremunerative service, as it requires not only engineman and fireman, but also fuel, water and oil, and adds a proportion to the repair costs, while there is no transportation of changeable commodity. As a rule, enginemen are paid reduced rates for such mileage; thus, one road states that enginemen running light will be paid passenger rates, as per class of engine, and as these are usually less than freight rates, there is a reduced pay, if it happen to be a freight engine, as is generally the case. However, in contradistinction to this, we find some rules that say the pay will be according to the class of train over each district. This is somewhat ambiguous, as there is really no train, but it is evidently meant that a freight engine will entitle the engineman to freight rates.

Sometimes we see a heavy freight train sent out with one engine, and either preceding or following it, a light engine is sent in the same direction. It might in this case save the wages of a train crew, but frequently this crew must be moved also. It would be more economical to either split the train, or at least double head, as the fuel economy would be greater, and the train reach its destination quicker. Of course, if the light engine leads, it can make better time than the loaded one, but there may be such traffic conditions existing, that little will be gained by the light engine. The real object of such an arrangement often is to make an apparent record for heavy tonnage per train-mile, or per loaded engine-mile, regardless of cost.

POOLING.

Something should perhaps be said here on the subject of pooling. While it does not ordinarily affect the cost of operation as far as the pay of the crew is concerned, it doubtless has an effect upon some of the other lines of expense. Some of the reports made to the last International Railway Congress (1905) on the subject of pooling were very clear on this item of expense. In the report by Mr. Camille Boell, representing an equipment of 22,000 locomotives, mostly in Central Europe, it is concluded "that the pooling system always leads to a very perceptible increase in the expense per mile, and therefore it ought not to be employed, except in case of absolute necessity." Only one of the roads included in the report uses the system exclusively, the St. Gothard, of Switzerland, it having been in force on this road since 1888. By comparing the expenses for 1886 and 1889, the following increases have been found:

Fuel	5.5 per cent.
Lubrication	42.0 "
Maintenance	11.6 "

Other causes have no doubt had their influence upon these expenses, notably an increase in the speed of trains and weight of engines, so it is impossible to determine the proportion of these increases due to pooling. While many roads believe there will always be an increase in the above expenses due to pooling, we at times find those who profess to believe otherwise. There is little doubt, however, that the prevailing impression is that an increase in cost always follows pooling, and that it is a practice that is of benefit during a congestion of traffic, when the men are not able physically to stand the mileage which the engines can, but which should be abandoned when the normal conditions are restored. Double and treble crewing will often permit the engines to make as much mileage as when in the pools, and with much better satisfaction all around.

EFFECT OF SPEED.

The speed of the train is about the only element which affects the cost of engine running, if by this term we mean "average speed," or miles between terminals divided by time between the same as loading, stops, switching, etc., affect the speed between terminals, so the cost will be affected, but only because these items alter the speed. Then it is only below certain limits that even the speed affects the cost. We have seen that in most of the schedules for freight engineers, the pay is practically by the mile, as long as an average of 10 miles an hour is maintained. If 15, 20 or 30 miles an hour be maintained or averaged between terminals, the pay will be by the mile, providing the run is at least 100 miles, and that constructive mileage does not apply. Therefore, for speeds in excess of 10 miles per hour there is no change in this item of cost. Of course, a difference per ton-mile may be obtained by changing the lading so that the engine can maintain a higher velocity, and as far as loading is concerned, the least cost for enginemen's wages per ton-mile will occur when the locomotive is so loaded that it can just "average" ten miles an hour over the road.

When the speed is less than ten miles, however, the effect on this cost is great. Suppose, for instance, a running rate of five miles an hour is the best that can be done, owing to layouts or too much tonnage. If the distance be 100 miles, the trip will consume 20 hours, and the engineman will be entitled to 10 hours overtime, and as the usual rate for this is equivalent to 10 miles an hour, he will actually be paid for 200 miles, though running but 100. This is just double the cost per engine or train-mile. Consider what happens, however, if the run is less than 100 miles, say, 60, for example. At 5 miles an hour, 12 hours will be consumed. Overtime will not apply until he has been out 10 hours, as pay is allowed for 100 miles in any case. He will, therefore, be entitled to 100 miles plus 2 hours' overtime, equivalent to 20 miles, or a total of 120 miles. This is again double rate, as in our last discussion. Now, if the trip had been made at 6 miles an hour, or 10 hours for the trip, or any speed in excess of 6 miles, he would be paid for 100 miles without

any overtime, so that the actual rate would be 10/6, or 66 per cent. increase over the standard rate per mile, due to the constructive mileage on a run of less than 100 miles. Thus we see that the speed limit for changes in cost "per engine-mile" depends on the length of the run, as generally set forth by the various schedules.

(To be continued.)

Valve Gear of the Symons Four-Cylinder Balanced Compound Locomotive.

It will be remembered that the first of the Baldwin Locomotive Company's four-cylinder balanced compounds was completed in 1902 for the Plant System, of which W. E. Symons was then Superintendent of Motive Power, and that he had part in designing this locomotive. Mr. Symons has lately taken out patents on an independent design of four-cylinder balanced compound locomotive, with separate patents on the valve gear. The drawings of the latter, taken from the patent specification are reproduced herewith; also the relative arrangement of high and low pressure cylinders, which are separated and given independent valves and valve gears, together with their piping, which will permit the independent use of either the high or low pressure cylinder when desirable or necessary.

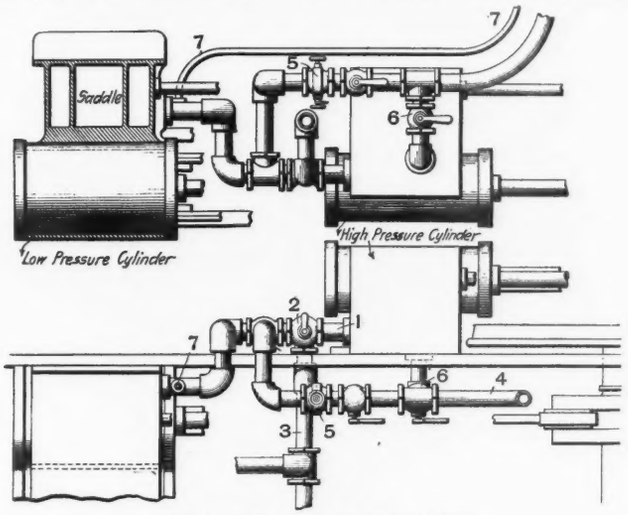


Fig.1—The Symons Valve Gear.

Taking up the last-named features first and referring to Fig. 1, it will be seen that the low-pressure cylinders are inside the frames, under the saddle, connecting to the crank axle of the front pair of drivers. The high-pressure cylinders are outside of the frames, back of the low-pressure cylinders, and connect to the rear drivers. The exhaust pipe from the high-pressure cylinder to the steam chest of the low-pressure cylinder is shown at 1, and 2 is a cut-out valve which will divert the exhaust into the emergency exhaust pipe 3 when desired. To supply live steam to the low-pressure cylinder when the high-pressure cylinder is out of service, an extension to steam pipe 4 connects, through a pressure-reducing valve, 5, with exhaust pipe 1 beyond the cut-out valve, the high-pressure cylinder being cut-out by valve 6.

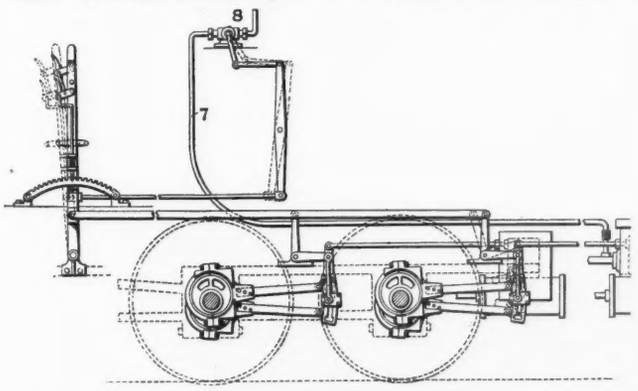


Fig. 2—The Symons Valve Gear.

Admission of live steam to the low-pressure cylinder at starting is obtained through pipe 7, Figs. 1 and 2. This pipe extends from the dry pipe through a three-way auxiliary valve, 8, the arm of which is connected by a link to a lever having its opposite end connected by a rod to the lower end of the primary reversing lever in the cab. When the latter is in the front or back "corner" live steam will be admitted to the low-pressure valve chest. The moment the lever is moved out of either of these extreme positions, this live steam is shut off.

Independent valves and gears are provided for the high-pressure and low-pressure cylinders, and in this mechanism is comprised one of the novel features of the design, namely, the provision for independent adjustment of the cut-offs of these cylinders. The purpose is to enable the most favorable ratio of steam volume to be maintained between the two cylinders according to the speed of the locomotive and the weight of train, following European practice in this respect. The scheme embraces two reverse levers (Figs. 2 and 3), known as primary and auxiliary. They may be regarded as twin levers, or as parts of one lever, for while they are designed to have a limited relative movement, they are adapted to swing in unison, and they perform the same function, although for different sets of valves. The reach rod moving the high-pressure links is attached to the primary lever and that from the low-pressure links to the auxiliary lever. The relative movement of the two levers is limited under ordinary service conditions by a detachable stop-bar having stops at each end. The bar is made detachable to enable it to be removed quickly in case it should be desired to increase the range of movement, or leave one lever in a fixed position under such conditions, for instance, as one pair of cylinders being out of service. Each lever has its individual toothed quadrant and spring latch.

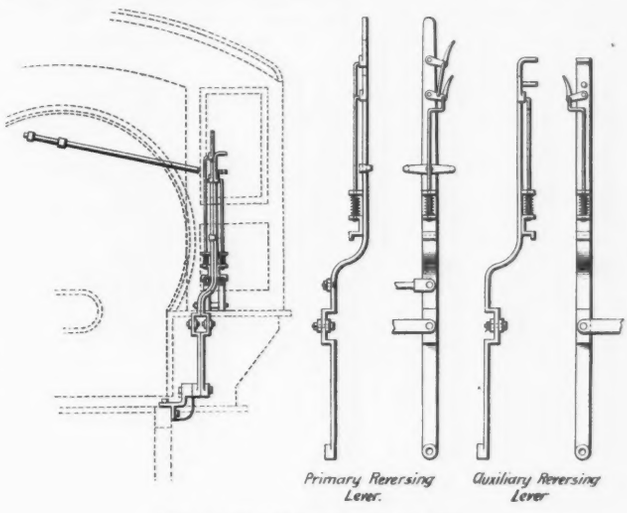


Fig. 3—The Symons Valve Gear.

British Standard Specifications for Cement.*

BY ROBERT W. LESLEY.
Vice-President American Society for Testing Materials.

It is interesting to compare the American standard specifications for Portland cement which were recently adopted by the American Society for Testing Materials and those adopted in December, 1904, by the Engineering Standards Committee of Great Britain.

On the first item of the definition of Portland cement, the British specification suggests both water and sulphate of lime as materials which may be added to retard the setting, and covers both in its specification, limiting the amount in either case to 2 per cent. In the American specification, any addition, subsequent to calcination, is limited to 3 per cent.

On specific gravity, both specifications practically agree to 3.10, but the English specification raises the amount to 3.15 where the cement is sent direct from the mill to the laboratory in tightly sealed packages.

On fineness, there is a material difference in the screens used, and it may be stated that the American specification, which has 8 per cent. on a No. 100 (10,000 mesh) sieve and 25 per cent. on a No. 200 (40,000 mesh) sieve would require a finer grinding than the British, which has 3 per cent. on a 5,776 mesh sieve, or 22½ per cent. on a sieve of 32,400 meshes.

In the matter of setting, the specifications are again at variance. Our specifications require that the cement shall develop initial set in not less than 30 minutes, but must develop hard set in not less than one hour, nor more than ten hours. The English specification recommends three distinct grades of setting time, designated as quick, medium and slow. The first is not less than 10 minutes nor more than 30 minutes; the second in not less than one-half hour nor more than two hours, and the third in not less than two hours nor more than five hours, and yet while these grades of time of setting are recognized, and each of them will have a material bear-

*Extracts from a paper read before the American Society for Testing Materials.

ing upon the tensile strain of cement, the British specification, in the matter of tensile strength, has but one series of limits, namely:

7 days.		28 days.	
Neat	400 lbs.	Neat	500 lbs.
3 sand, 1 cement	120 lbs.	3 sand, 1 cement	225 lbs.

The American specification on the other hand, while not recognizing different classes of cement, so far as the time of setting is concerned, does recognize different strengths in tension, and has what the British specification has not, a 24-hour test which may possibly in some quarters be considered superfluous for Portland cement. The American requirements are:

7 days.		28 days.	
Neat	450 to 550 lbs.	Neat	550 to 650 lbs.
3 sand, 1 cem't.	150 to 200 lbs.	3 sand, 1 cem't.	200 to 300 lbs.

and are all higher than those of the British specification, which is no doubt due to the fact that there is more rotary cement manufactured in our country than possibly anywhere in the world.

More interesting, however, is the difference in the matter of gain in strength at longer periods, a new requirement which has only come into cement testing since the introduction of the Rapid Transit specification in New York. In the United States, in view of the fact that the matter has not been thoroughly settled, we recognize broadly that no cement shall show retrogression. In the English specification, however, this question of the increase of strength between the 7-day and 28-day periods is graded according to the initial strength shown by the cement at the 7-day period, which seems to be a very fair method of determining increased strength between the periods stated. In their specification, a cement showing 400 to 450 pounds at 7 days is to gain 25 per cent. in 28 days; 450 to 500 lbs., 20 per cent.; 500 to 550 lbs.,15 per cent., and all over 550 lbs. at 7 days, an increase of 10 per cent. at 28 days. This is a very fair view of the subject, as a cement that pulls 600 to 800 lbs. at 7 days will have to increase very many pounds in tension to acquire the strength to show 25 per cent. increase between the 7 day and 28 day periods, while a 10 per cent. increase would be a much more reasonable figure.

The great and salient difference between the two specifications is that governing the test for constancy of volume, or what are known technically as accelerated tests. In our specification, we have adopted the hot and cold water tests prescribed under the German normal test, and which have been in use so successfully for so many years, and have supplemented them by a steam test after the cement is set for 24 hours, consisting in exposing the pat in an open vessel to steam rising from a body of water beneath. The British have adopted what is known as the Le Chatelier test, which is fully described in the specification, and which so far has not been generally adopted outside of France. This is the part of the specification which up to date has attracted most criticism, by reason of possible inexperienced operators not producing similar results, with similar cements under similar circumstances.

The chemical requirements of the cement differ in the two specifications as follows:

In the American specification 1.75 per cent. of anhydride sulphuric acid is permissible, while in the British specification the limit is run up to 2.5. In England 3 per cent. of magnesia is allowed, as against 4 per cent. in this country. Insoluble residue in England is limited to 1.5 per cent. for reasons that may not be necessary in this country.

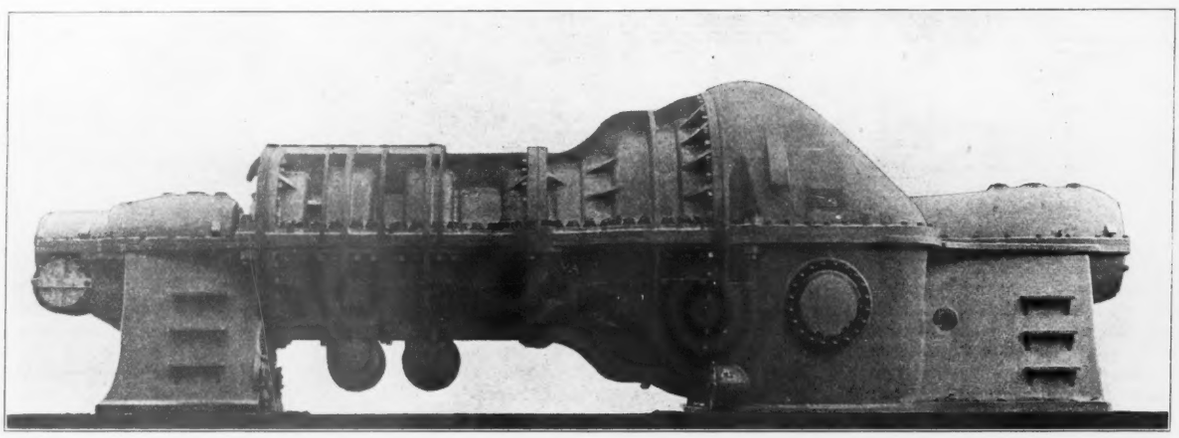
Another interesting thing in the English specification is that there shall be no excess of lime; that is to say, the proportion of lime shall not be greater than is necessary to saturate the silica and alumina present, or represented by the formula $\frac{CaO}{SiO_2\ Al,\ O_3} = 2.75$.

Of course, this would be covered by the analysis of cement described in the methods of manipulation of tests of the American Society of Civil Engineers and the methods of analysis of the American Chemical Society, which are part of the American specification.

It is interesting to note that while the American standard specification has so far stood fire very well, and even its makers can only suggest unimportant corrections, the English standard specification has not been so fortunate. From several quarters there has been some little criticism on the accelerated test, accompanied by statements of different results on the same sample. There have also been some other unimportant criticisms on chemical composition. Whether the difference in mental attitude to the new specification in the two great English speaking countries is due to the respective national characteristics of their people, is still to be determined.

Allis-Chalmers Steam Turbine for the Brooklyn Rapid Transit Company's New Power House.

The sixth large power plant to be built for the Brooklyn Rapid Transit Co. will show, in some respects, a radical departure from the features usually found in stations where reciprocating engines are installed. Among the more important of these is the small floor space needed for the machinery. The engine room of the ordinary station requires about 60 per cent. of the total ground space, and the boiler section about 40 per cent. In the new turbine plant, the turbine floor occupies but two-thirds the space required for the boilers. In other words, a turbine station of a given capacity requires only two-thirds of the ground room needed by a reciprocating engine station. The importance of this is at once apparent in localities where real estate is costly. It also means an equivalent saving in expense incurred for buildings. The new Williamsburg station, which has been erected near the bridge of that name, is designed to accommodate a total of nine steam turbine and generator units, three of which are now being installed. One of the most interesting of these is an Allis-Chalmers 9,000 h.p. unit shown in the accompanying illustration.



The Allis-Chalmers 9,000 h.p. Steam Turbine for the Brooklyn Rapid Transit Company's New Power House.

This turbine is of the horizontal multiple expansion, all-around parallel flow type, generally known as the "Parsons" type, operating at 750 r.p.m. The generator is a "Bullock" alternating current machine built by the Allis-Chalmers Company at its Cincinnati works. It will carry 25 per cent. overload continuously and a 50 per cent. overload for three hours with but a small temperature rise.

A noteworthy feature in the construction of the Allis-Chalmers turbine is the blading; the blades are made of a special alloy and of such form and dimensions as will secure the highest economy. The individual blades are mounted in groups, each group forming one-half of a circular row. The inner ends of the blades are swaged, and are secured in slots in the foundation rings and riveted in slots in their respective channel shaped shrouds. The blade rings are secured by calking strips in machined grooves in the cylinder and rotor. The channel shaped shroud secures the blades at the proper angle and spacing and eliminates the danger of stripping, permitting the turbine to be safely operated with a minimum radial clearance. A direct acting steam pump for use on starting up the turbine is provided. The turbine and generator rotors are direct-connected by a flexible coupling, each being carried in two bearings of the ball and socket type.

The turbo-generating unit measures approximately 47 ft. in length, over all, by 13 ft. 3 in. in width, and 11 ft. 6 in. in height above the engine room floor. Its height above the foundation is scarcely more than that of the low-pressure cylinder of a reciprocating engine, of equal capacity, above the upper platform, and such cylinders are frequently more than 30 ft. above the engine foundations.

GENERAL NEWS SECTION

NOTES.

The yard masters at various points on the Pennsylvania Railroad have had their working day reduced from 12 hours to 8.

The Southern Railway now runs a Pullman compartment sleeping car between Washington and Asheville, for the "high-class travel" between those points. The service will be twice a week each way.

At the new Angus shops of the Canadian Pacific the company will establish two dining-rooms, with a seating capacity of 400, and it is proposed to furnish the mid-day meal for employees at cost, or less.

Philadelphia newspapers say that the Pennsylvania Railroad has issued a notice to its freight agents and solicitors cautioning them to observe strictly the spirit and the letter of the Interstate Commerce law regarding freight rebates and discriminations.

The Exchequer Court at Ottawa, Ontario, has awarded H. M. Price $55,856 damages against the Dominion Government for losses due to forest fires on land adjacent to the Intercolonial Railway, the court holding that the fires were caused by sparks from locomotives.

The Missouri, Kansas & Texas is to take a trainload of editors to Indian Territory and other attractive regions on the company's lines for the purpose of advertising the country as a good place for settlers. The guests to be invited are the country editors of Illinois, Indiana, Ohio and Kentucky.

Chicago reporters say that the western railroads complain that eastern connections do not furnish full and correct information on waybills as to gross, tare, and net weight of cars for points west of Chicago. It is claimed that the Central Freight Association weighing and inspection bureaus at Buffalo, Pittsburg and elsewhere fail to weigh many of the cars going west.

A complaint has been filed with the Kentucky Railroad Commission, by a number of coal shippers in eastern Kentucky against the Ashland Coal & Iron Railroad and Chesapeake & Ohio. The shippers complain that recently the two railroads have violated an agreement made under an order of the Commission two months ago by restoring a full local rate over both lines on through shipments.

A correspondent of the *New York Herald* says that very large quantities of freight are seriously delayed at the Atlantic terminus of the Panama Railroad because of the inability of the road to carry it. It is said that 800 cars are needed for the traffic, while the company has available only 200. More than half of the 500 cars owned by the road are now in use for carrying supplies for the construction forces of the canal.

The New Hampshire state railroad commissioners have made a ruling on the method of conducting hearings on railroad accidents which will prevent attorneys for clients who may be plaintiffs in suits against the railroad from questioning witnesses. The commissioners will conduct the examination of witnesses and will decline to furnish copies of the testimony. The hearings on accidents will be public as heretofore.

At Forth Worth the ticket scalpers have turned on the railroads and have secured from the state court a temporary injunction restraining the railroads from interfering with brokers who sell unused portions of tickets. The scalpers allege that the contract made with a passenger when selling tickets is a pretence; the railroad company stipulates that the tickets are not transferable, but under the law it is claimed that they are transferable. The petition alleges that such a form of agreement is an attempt to stifle competition and violates the anti-trust law of Texas. The ticket scalpers are trying to protect their business during the state fair at Dallas.

A committee of the General Managers' Association of Texas Railroads has protested against the State Board of Health's rules governing the disinfecting of passenger cars, and the Board has agreed to modify them. The rule requiring one cuspidor in a car for each seat or every two chairs will be modified so that cuspidors shall only be used when demanded by a passenger. A supply of them will be carried in each car and they will be furnished to passengers on request. The rule requiring the use of a disinfecting solution in cuspidors has been abolished, but the cuspidors must be kept clean. The railroads have agreed to pay the expenses of sanitary inspectors to see that passenger cars are kept clean.

The Interstate Commerce Commission, in a general investigation, holds that the freight rates in force from St. Louis to Texas common points prior to March 15, 1903, afforded reasonable compensation to the carriers, and as they had been in effect for a long period, and the material advances of such rates on that date were made through concerted action of the carrier, justification for the advances should be clearly shown; but as there is no complainant demanding relief from some particular rate, and no particular rates have been investigated; and as there is no evidence that the financial condition of the roads is weak, the commission does not feel warranted in making an order condemning such advances, though it is believed that they were improper.

Interstate Commerce Commission Decisions.

The Interstate Commerce Commission, in the case of the City Gas Company of Norfolk, Va., decides that the Baltimore & Ohio, in carrying coal from Pennsylvania to Baltimore must not charge a lower rate on that going to points "inside the Capes" than on that going to Norfolk. It appears that on coal for Norfolk proper the railroads leading to that city have made an agreement not to compete, whereas on coal carried to other places, both along the bay between Baltimore and Norfolk and to points "outside the Capes," competition is free. The decision says that the B. & O. does not desire to participate in the coal traffic to Norfolk, and this discrimination in favor of other points is declared unjust and illegal.

The Interstate Commerce Commission has announced its decision in an opinion by Commissioner Fifer, in the case of Spiegel v. the Chesapeake & Ohio and the Pennsylvania. It was claimed that the rates on lumber to Philadelphia were unlawfully higher from Afton, Va., and other points than those for the longer distance over the same line from Staunton and Basic City. Effective competition was shown by defendants at Basic City and Staunton, and the Commission decides that the higher rate from the Afton group does not constitute unlawful discrimination.

Concessions to Russian Railroad Strikers.

According to a press despatch of November 4, the Russian Government, speaking through Count Witte, has had a conference with the leaders of the railroad strike and has granted seven important points, as follows:

1. The remuneration of all railroad employees is increased and the Budget of 1906 will be revised to provide therefor.

2. The creation of a commission on which the employees are to have elected representatives to consider questions of improvement in their condition.

3. Permission is given railroad employees and workmen to have a co-operative organization like those of Western Europe and the United States.

4. The abolition of military regulations applying to railroads.

5. Freedom of meeting for employees of railroads to discuss questions of a strike without notice being given to the police.

6. Inviolability of the person of strikers and the re-employment of men dismissed for striking.

7. Cancelling of all circulars limiting the employment of Poles on the Polish Southwestern and the Western Railroads, and giving permission to use the Polish language in private on Polish railroads.

It is said that under this settlement all the railroads have resumed normal operations.

The $2 Chicago Stock-Yards Charge.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the stock yards case, remanded to it by the Supreme Court of the United States.

Prior to June 1, 1894, live stock was delivered at the Union Stock Yards in Chicago without additional charge. On that date the Burlington and other defendant railroad companies imposed a terminal charge of $2 per car. Complaint was made by the Texas Cattle Raisers' Association, with the Chicago Live Stock Exchange as intervener, and the commission decided that any charge in excess of $1 would be unreasonable. This case went to the Supreme Court of the United States, and that court, while agreeing with the commission that $2 was unreasonable, held that from certain territory where a reduction in through rates had been made effective in 1896 the charge might not be unreasonable, and as that territory was not defined in the record, the court was constrained to dismiss the case, but remanded it to the commission for further proceedings. The commission now finds that excluding the territory covered by the reduction of 1896, live stock rates were on May 31, 1894, reasonable compensation for the service performed, including delivery at the Union Stock Yards. At all times since that date such rates have been, and now are, sufficiently high to include a delivery at the stock yards, but the cost of delivery in Chicago has been increased by the trackage charge paid by defendants to the Stock Yards Company. Such increased cost of delivery, that is to say, such trackage charge,

is fairly estimated for all the defendants at one dollar per car. The commission holds (1) that delivery to the Union Stock Yards prior to June 1, 1894, was included in the rate and was in no sense a gratuity; (2) that outside of the excluded territory, a terminal charge for delivery to the Union Stock Yards in Chicago of $1 per car is reasonable, and defendants' terminal charge of $2 per car, exacted since June 1, 1894, is unreasonable. The case is retained for further proceedings in the matter of reparation.

The "Pennsylvania (18-Hour) Special."

A report is published to the effect that this train, westbound, has reached Chicago on time 138 days out of 142; and of the four detentions the longest was 13 minutes, caused by the derailment of a freight train near Chicago.

A press despatch from Chicago, of November 4, says that the 18-hour train arriving in that city on the morning of that day (on time) left Harrisburg, Pa., two hours late. The distance from Harrisburg to Chicago is 717 miles, and if the train started two hours late it thus made the run in 12 hrs. 21 min.; equal to 58.06 miles an hour. From Harrisburg to Altoona, 132 miles, the time was 116 min., equal to 68.3 miles an hour. On this division the grades westbound are nearly all ascending, or level, few or none being descending.

Central Railroad Terminal Improvements at Jersey City.

The Central Railroad of New Jersey has begun the work of reclaiming a tract of swamp land in the Communipaw section of Jersey City, estimated to be a mile square. It lies between the present freight yard and the tracks leading to the National Docks & Storage Company on the west and between the main line tracks and New York bay. It will require a great quantity of earth, and a year and a half will be consumed in completing the job. On the river front south of the ferry terminus on the North river a new open pier 1,100 ft. long will be built. This will be followed by other piers and coal trestles, both on the river and the bay fronts. A new 20-stall roundhouse is to be built at the west end of the yard. On account of the riparian rights involved the company made application to the Government last spring for permission to begin the work, and this was granted late in the summer. The cost of the present work is estimated at $1,500,000. The contractor is J. A. Taylor, Jersey City.

Hall Signals on the New York Central.

The Hall Signal Company has closed a contract with the New York Central for the equipment of the West Shore Railroad between West Cornwall and Haverstraw, 20 miles, with Hall automatic normal-danger block signals.

Mississippi Railroad Commission.

The forthcoming report of the Mississippi Railroad Commission will show the total railroad mileage in the State on September 30 to be 3,503.79 miles, an increase of 361.58 miles in two years. The total valuation of railroad property in 1905 is given at $36,316,800, which nets the State in taxes $65,141.30. Sleeping car, express, telegraph and telephone companies are valued at $1,487,543, on which the State receives $8,925 in taxes. During the last two years 96 persons were killed and 876 were injured on the railroads in the State, as compared with 122 killed and 440 injured during the previous biennial period.

Steam Turbines in Washington Terminal Station.

When the large Union Station at the Washington terminal of the Pennsylvania Railroad is completed, steam turbines will be used as prime movers partially on account of the limited amount of space devoted to that purpose. Four 500-kw. steam turbines have been ordered from the Westinghouse Machine Company, adapted for driving alternating-current 60-cycle generators running at 3,600 r.p.m. Dry saturated steam will be used at 150 lbs. pressure and 25 in. vacuum, and the turbines will be capable of developing 670 electrical h.p. each. The alternating-current generators will be of the turbo rotating-field type, with two poles and a frequency of 7,200 alternations per minute at a normal speed of 3,600 r.p.m. They will deliver three-phase current at 2,300 volts, and, being of the enclosed type, will operate practically without noise.

Manufacturing and Business.

The San Francisco office of the National Tube Co. has been moved from 420 California street to the Union Trust Building.

The Atchison, Topeka & Santa Fe's new elevator to be built in Chicago to replace the one recently destroyed by fire will have a capacity of 1,400,000 bushels and cost $600,000.

Mr. C. H. McCullough, Jr., has been elected a Vice-President and also General Manager of the Lackawanna Steel Co., with office at Buffalo, N. Y.

W. W. Rosser, formerly with the Washburn Coupler Co., has accepted a position with the T. H. Symington Company as Sales Agent in the Western Office, Railway Exchange, Chicago.

Mr. A. P. Peck, who has been electrical sales agent for the National Electric Co., has been appointed sales agent of the Allis-Chalmers Co., and will work in the New York district.

Burns & McDonnell, Kansas City, Mo., civil, hydraulic and sanitary engineers, have removed their offices into larger quarters at 709 and 710 Dwight Building. This firm makes a specialty of municipal sanitary and hydraulic engineering.

Vice-Consul Battiste at Port au Prince reports that the Haytian Legislature has granted a concession to the National Railroad Co. of Hayti, in which a number of Americans are interested, to build a railroad from Gonaives to Hinche.

The Railroad Supply Co., Chicago and New York, reports a large and increasing demand for its "Chicago" channel pins tinned by a special process. It is claimed that these pins drive easier and quicker and make a more permanent and better contact between rail and bond wire.

The Independent Pneumatic Tool Co. has received an order from England for 200 "Thor" piston air drills, reversible wood boring machines and pneumatic riveting and chipping hammers. On account of increased business, the company intends to enlarge its plant at Aurora, Ill.

I. M. Cook, for the past eight years lumber buyer for the Pullman Company, has opened an office at 1338 Monadnock Building, Chicago, to engage in business on his own account. His experience with the Pullman Company extended over a period of 19 years. He will handle lumber of all kinds, also veneers, and will make a specialty of car stock.

The Wilmarth & Morman Co., Grand Rapids, Mich., reports business for October to have been unusually good, particularly in foreign shipments, many machines having been sent to England, France, Norway and Canada. Domestic shipments included the New York Central and Louisville & Nashville railroads and a considerable number of business and industrial concerns.

At the meeting of the board of directors of the American Steel Foundries on November 2, the following elections and appointments were made: Delmer W. Call, Assistant to President; W. W. Butler, Second Vice-President; R. H. Ripley, Fourth Vice-President. Mr. Call, who assumes a prominent position in the management of the company, has for a great many years been connected with the National Malleable Castings Co., Cleveland, Ohio.

The Indestructible Fibre Co., 45 Broadway, New York, has received the order for the car head-linings, ¼ in. thick, and for the hood material, ½ in. thick, for the 125 New York Central cars to be built by the American Car & Foundry Co., and electrically equipped, for service between New York City and Westchester. The material which the Fibre Co. will furnish will not only be fireproof, but, in case of accident, it will not splinter. The company has a new plant at Massena, N. Y., for making car head-linings and hood materials.

PERSONAL.

—Mr. A. J. Stone, in becoming Assistant General Manager of the Erie, returns to that road after an absence of just two years. He had served in various capacities in branches of the operating department, beginning in 1887, and became Assistant to the General Manager in 1902. In November, 1903, he went to the Delaware & Hudson as Assistant to the Second Vice-President, and a month later was made General Superintendent, where he has been until his recent appointment on the Erie as Assistant General Manager.

—Mr. E. B. Pryor, who was recently elected Fourth Vice-President of the Wabash, was born in West Virginia in 1854. His entire railroad service has been on the Wabash. He started in 1880 as a clerk on the Wabash, St. Louis & Pacific, predecessor of the Wabash, and was later appointed general bookkeeper and chief clerk of general accounts. In 1887, he was made Assistant Auditor, and three years later was appointed also Assistant Secretary and Assistant to the Vice-President. In 1903, he was made Assistant to the President, from which office he received his present promotion.

—Mr. A. DeBernardi, who was recently appointed General Superintendent of the Central district of the Missouri Pacific, was born in Missouri in 1865, and his entire railroad service has been with the Missouri Pacific. He started his railroad work in 1882 as a laborer, becoming section foreman in 1885 and working up through successive stages to the position of division roadmaster in 1893. In 1899, he was made trainmaster, and in 1900, Division Superintendent at Concordia, Kan. The next year he was transferred to Osawatomie, Kan., where he remained until his recent appointment.

—Mr. W. S. St. George, who was recently appointed General Passenger and Ticket Agent of the Missouri, Kansas & Texas, is 53 years old. He was born in Ireland, but came to this country at an early age and began railroad service as a clerk on the Port Royal & Augusta in 1876. He became contracting agent and then

resigned and was out of railroad service for a while. In 1882, he resumed railroad work as freight agent at Savannah for the Savannah, Florida & Western. At the end of that year, he went to the Cincinnati, New Orleans & Texas Pacific as General Southern Agent and was later made General Agent of the entire system. In 1884 he was appointed General Eastern Agent, remaining there for ten years, and then taking the same position on the Missouri, Kansas & Texas, where he has been until his present appointment.

—Mr. D. C. Moon, who has been appointed General Superintendent of the Lake Shore & Michigan Southern, began railroad work in 1872 as a telegraph operator on the Dunkirk, Allegheny Valley & Pittsburg, a leased line of the New York Central. He was agent for a short time, then train despatcher, then in the Auditor's office, and, in 1890, trainmaster. Three years later he was appointed Assistant Superintendent of the road, and in 1896, Superintendent at Dunkirk, N. Y. In 1899 he was transferred with the same title to the Rome, Watertown & Ogdensburg division of the New York Central. He was promoted to the office of Assistant General Superintendent of the Lake Erie & Western in 1902, and the next year was made Assistant General Superintendent of the Lake Shore & Michigan Southern, with office at Cleveland, where he remained until his recent appointment.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. D. Stuart, Assistant Freight Auditor, has resigned. E. L. Mooney succeeds Mr. Stuart, with office at Topeka, Kan.

Brooklyn Rapid Transit.—Eugene Klapp, Chief Engineer, has resigned. W. S. Menden succeeds Mr. Klapp.

Cincinnati, Hamilton & Dayton.—W. C. Andrews has been appointed Acting Superintendent of Car Service, succeeding F. S. Rawlins, resigned.

See Erie.

Delaware, Lackawanna & Western.—B. H. Hawkins has been appointed Master Mechanic at Buffalo, N. Y., succeeding F. W. Williams, resigned.

Erie.—The authority of the vice-presidents has been extended over the Cincinnati, Hamilton & Dayton and the Pere Marquette, as follows: G. F. Brownell, First Vice-President, will have charge of the legal department, including real estate and taxes; G. A. Richardson, Second Vice-President, will have charge of finance, accounting and the coal companies; H. B. Chamberlain, Third Vice-President, of traffic; J. M. Graham, Fourth Vice-President, of engineering and construction; Russell Harding, of operation and maintenance.

M. P. Blauvelt, Comptroller of the Erie, has been made Comptroller of the Cincinnati, Hamilton & Dayton and the Pere Marquette also. J. L. Cramer, Comptroller of the Cincinnati, Hamilton & Dayton, has been appointed Assistant Comptroller of the three roads.

E. A. Williams, Assistant General Manager, has been appointed General Mechanical Superintendent of the Erie and of its allied and controlled lines, with office at New York.

Galveston, Harrisburg & San Antonio.—G. E. Bissonnet, Auditor of Passenger Accounts, has resigned. F. J. Cox, Chief Clerk in the Passenger Auditing Department, succeeds Mr. Bissonnet, with office at Houston, Tex. See Southern Pacific.

Grand Trunk Pacific.—A. C. Dennis, Assistant Division Engineer at Winnipeg, has been appointed Division Engineer at that place, succeeding E. R. McNeil, deceased.

Michigan Central.—The authority of J. R. Smart, Superintendent of Dining Car Service of the New York Central and of the Lake Shore & Michigan Southern, has been extended over the Michigan Central. C. R. Emery, heretofore Superintendent of Dining Cars of the Michigan Central, is now Assistant Superintendent of that department.

Missouri Pacific.—C. H. Miller has been appointed Engineer of River Protection.

New Orleans & Northeastern.—P. Millard, Purchasing Agent, has resigned. W. J. Kelleher, Secretary to the President, succeeds Mr. Millard.

New York Central Lines.—B. B. Mitchell, General Freight Traffic Manager of the Michigan Central, has been appointed Freight Traffic Manager of all the New York Central Lines west of Buffalo, except the New York, Chicago & St. Louis, with office at Chicago.

Pere Marquette.—See Erie.

Southern Pacific.—G. E. Bissonnet, Auditor of Passenger Accounts of the Galveston, Harrisburg & San Antonio, has been appointed Ticket Auditor of the Pacific system, with office at San Francisco.

Tennessee Central.—The following new officials have been elected to serve until December 1: President, J. M. Overton, succeeding J. C. Vanblarcom; Treasurer, J. P. Howell, succeeding E. A. Faulhaber; Directors, J. M. Overton, C. N. Burch, A. P. Humphrey and W. J. Murphy. The former directors were: J. C. Vanblarcom, G. A. Clark, John A. Pitts and W. D. Witherspoon.

LOCOMOTIVE BUILDING.

The Lehigh Valley will shortly order a number of locomotives.

The Kansas City, Mexico & Orient, it is reported, has ordered six locomotives.

The Great Northern, it is reported, is figuring on a number of new locomotives.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered two locomotives from the American Locomotive Co.

The Philadelphia & Reading, it is reported, has reserved space with the Baldwin Works for 50 additional freight locomotives for 1906 delivery.

The Spokane & Inland, as reported in our issue of September 22, has ordered six electric locomotives from the Westinghouse Electric & Manufacturing Co.

The Baltimore & Ohio, as reported in our issue of October 20, has ordered 210 consolidation locomotives and 35 Pacific locomotives. The consolidation locomotives will weigh 209,200 lbs., with 186,600 lbs. on drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 60 in.; straight top boiler with wide firebox, having a working steam pressure of 205 lbs.; total heating surface, 2,809 sq. ft.; 282 charcoal iron tubes, 2¼ in. in diameter x 15 ft. 10 in. long; firebox, 107⅝ in. x 75¼ in.; grate area, 56.24 sq. ft. The tender will have a capacity for 7,000 gallons of water and 13 tons of coal. The Pacific locomotives will weigh 218,000 lbs., with 140,500 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of driving wheels, 74 in.; straight top boiler with wide firebox, having a working steam pressure of 205 lbs.; total heating surface, 3,395 sq. ft.; 276 tubes, 2¼ in. in diameter x 20 ft. long; firebox, 107⅝ in. x 75¼ in.; grate area, 56.24 sq. ft. The tender will have a capacity of 7,000 gallons of water and 13 tons of coal. The special equipment for these engines includes: Westinghouse air-brakes, magnesia boiler lagging, Diamond special brake-beams, Perfecto brake-shoes for the engines and Streeter brake-shoes for the tenders, Major couplers, Hancock injectors, B. & O. standard journal bearings, U. S. metallic piston and valve rod packings, Hayden safety valves, Leach sanding devices, Detroit bull's-eye sight-feed lubricators, B. & O. standard springs and heating equipment, and Ashcroft steam gages.

CAR BUILDING.

The National of Mexico, it is reported, is in the market for 10 beer cars.

The Cornwall & Lebanon, it is reported, is in the market for passenger cars.

Blair & Company, New York, have ordered one private car from the Pullman Co.

The Clarendon & Pittsford has ordered 20 flat cars from the Middletown Car Works.

The Pittsburg & Lake Erie, it is reported, is in the market for a number of passenger cars.

The Northern Pacific, it is reported, will soon consider the purchase of new passenger cars.

The National of Pehauntepec has ordered 300 box cars from the American Car & Foundry Co.

The Grand Trunk Pacific, it is reported, has ordered 3,000 box cars from the Canada Car Co.

The Mexican Central has ordered 70 Rodger ballast cars from the American Car & Foundry Co.

The Chicago & Milwaukee Electric has ordered 10 cars from the Pullman Co. and is figuring on additional cars.

The Atlantic & Birmingham Construction Co. is in the market for additional freight and passenger equipment.

The Cincinnati, New Orleans & Texas Pacific has ordered 250 flat cars from the American Car & Foundry Co.

The Lake Shore & Michigan Southern has ordered 600 Rodger ballast cars from the American Car & Foundry Co.

The Spokane & Inland has ordered 18 interurban passenger cars and two interurban express cars from the J. G. Brill Co.

The Central of New Jersey has ordered 50 cars from the Middletown Car Works. These cars will have steel underframes.

The Buffalo, Rochester & Pittsburg, it is reported, will shortly be in the market for new passenger equipment for 1906 delivery.

The Milwaukee Refrigerator Transit Company, Milwaukee, Wis., will buy or build 100 additional refrigerator cars about the first of the year.

The Great Northern, as reported in our issue of October 20, has ordered 300 ore cars of 100,000 lbs. capacity from the American Car & Foundry Co.

The Lehigh Valley has ordered 1,500 box cars of 80,000 lbs. capacity and 1,000 gondola cars from the Standard Steel Car Co. and 500 box cars from the American Car & Foundry Co.

The Armour Car Lines, Chicago, are building 200 of their standard fruit cars at their Chicago shops. These will be followed by an additional 400 of the same type, which will probably be completed this winter.

The Northern Pacific has ordered 500 National coal dump cars and will build at its own shops about 3,000 stock, coal and box cars in addition to the 3,000 cars ordered from the Pullman Co. and reported in our issue of November 3.

The Chicago, Burlington & Quincy has ordered 400 Hart convertible ballast cars from the American Car & Foundry Co. for February, 1906, delivery. These cars will weigh 39,500 lbs., and will measure 36 ft. long x 9 ft. wide x 8 ft. 3¼ in. high over all.

The Chesapeake & Ohio has ordered 2,000 gondola cars from the Western Steel Car & Foundry Co., 1,000 gondola cars from the American Car & Foundry Co., and 1,000 gondola cars from the Standard Steel Car Co., and is reported as having ordered 13 passenger cars from the Pullman Co.

The Cold Blast Transportation Company, as reported in our issue of October 27, has ordered 200 refrigerator beef cars of 60,000 lbs. capacity from the American Car & Foundry Co. for December, 1905, delivery. These cars will be 34 ft. 6 in. long and the bodies and underframes will be of wood.

The Atchison, Topeka & Santa Fe has ordered 100 tank cars from the Standard Steel Car Co. and 1,000 box cars from the American Car & Foundry Co. These are in addition to the 500 flat cars ordered from the Western Steel Car & Foundry Co. which were reported in our issue of November 3.

The Delaware, Lackawanna & Western, as reported in our issue of November 3, has ordered 500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., 500 box cars of 60,000 lbs. capacity from Barney & Smith, and is building 2,400 box cars, 200 stock cars and 100 carriage cars all of 60,000 lbs. capacity at its own shops.

The Indianapolis & Cincinnati Traction has ordered 10 passenger and four express freight cars from Barney & Smith for February, 1906, delivery. All of these cars will be 55 ft. long and 8 ft. 10 in. wide over all. The special equipment includes: Westinghouse air-brakes, Van Dorn couplers, Pantasote curtain material for the passenger cars and Baldwin trucks.

The Cincinnati, New Orleans & Texas Pacific is in the market for 250 flat cars of 80,000 lbs. capacity. These cars will be 40 ft. long and 8 ft. 10 in. wide, over sills. The special equipment includes: Buffalo brake-beams, Westinghouse air-brakes, Ajax brasses, Climax couplers, Miner tandem draft rigging, Harrison dust guards, Symington journal boxes, Railway Steel Spring Co.'s springs and arch-bar trucks.

The Twin City Rapid Transit is building 51 passenger cars at its Milwaukee shops. These cars will weigh 60,000 lbs. each, and will measure 34 ft. long x 9 ft. 3 in. wide x 11 ft. 8 in. high. The special equipment includes: Jones & Laughlin axles, National electric air-brakes, Curtain Supply Co.'s curtain fixtures and material, Baker heating system, Symington journal boxes, Baldwin trucks and Pittsburg standard wheels.

The Coal & Coke, as reported in our issue of October 27, has ordered three passenger coaches from the Pullman Co., for March, 1906, delivery. These cars will be 52 ft. long, 9 ft. 8 in. wide, over all, and 10 ft. ¼ in. high at eaves. The special equipment includes: Sterlingworth brake-beams, Westinghouse air-brakes, Janney couplers, Forsyth curtain fixtures, Pantasote curtain material, Safety heating system, and Coal & Coke Railway Co.'s standard paint.

The Atlantic Coast Line has ordered 15 wide-vestibule passenger cars from Barney & Smith. These cars will be 60 ft. long and the special equipment will include Westinghouse high-speed brakes and American slack adjusters, Climax journal boxes, Damascus bronze solid journal bearings, standard steel platforms, Westinghouse friction draft-gear, Barney & Smith walk-over seats, Pintsch gas lighting system, and Ajax diaphragms.

The New Orleans Great Northern, as reported in our issue of October 27, has ordered three coaches, three baggage, mail and express cars and one buffet parlor car from Barney & Smith. All cars will be 70 ft. long, 9 ft. 8 in. wide, and the coaches and buffet car will be 6 ft. 8½ in. high, the baggage, mail and express cars 6 ft. 1½ in. high, all inside measurements. The special equipment for all includes: Barney & Smith brake-beams, Christie brake-shoes, Tower couplers, Forsyth curtain fixtures and Blount door fastenings for coaches and buffet car, Magnus Metal Co.'s journal boxes, Pintsch light, Barney & Smith standard trucks and Pullman vestibules for coaches and buffet car.

BRIDGE BUILDING.

INDIANAPOLIS, IND.—Plans have been completed by County Engineer Harry Klausman and accepted by the Board of County Commissioners for the new bridge to be built at Thirtieth street over Fall creek. This will be the last bridge to be built out of the appropriation made for new bridges after the floods of 1904. The proposed structure will be a Melan arch consisting of three spans of concrete or reinforced concrete construction, 291 ft. long and 40 ft. wide, to cost $75,000.

IRONTON, OHIO.—A contract has been given to the American Bridge Co. which calls for 12,000 tons of fabricated steel for the new bridge to be built over the Ohio river between this place and Ashland for the Cincinnati, Hamilton & Dayton.

LITTLE ROCK, ARK.—County Road and Bridge Commissioner Reichardt has made surveys for a steel bridge 14 miles from this place in Brodie township.

MILWAUKEE, WIS.—The finance committee of the City Council has approved the issuance of $150,000 of bonds to pay part of the cost of the two bridges to be built at First avenue and at Sixth street. The committee also recommends the building of the Park bridge over the North-Western tracks at Riverside Park.

MORGAN CITY, LA.—The Southern Pacific has decided to build a steel bridge over the Atchafalaya river at this place to cost $500,000. The proposed bridge will be built on nine cylinder concrete piers just below the present structure and will consist of six fixed spans 235 ft. 6 in. each, with a draw 272 ft. long, making a total of about 1,682 ft. The company is also remodeling the San Jacinto bridge, and when this work is completed, the Southern Pacific line between New Orleans and San Francisco will, it is said, be able to carry the heaviest rolling stock.

OKLAHOMA CITY, OKLA. T.—The County Commissioners at a recent meeting decided to build a new steel bridge 100 ft. long over the Canadian river at the foot of Robinson street.

OWEN SOUND, ONT.—The Town Council will build a steel bridge over the Sydenham river to cost $10,000.

PAISLEY, PA.—The bridge to be built over the Monongahela river at McCann's Ferry by the Uniontown & Wheeling Short Line will be a double-deck structure somewhat similar to the Allegheny river bridge at Tenth street, Pittsburg. The upper deck will be used for a steam railroad and will carry one track. The lower deck will carry two tracks for an electric road and will also accommodate the highway traffic. The length of the entire structure will be between 1,500 and 1,600 ft. The channel span will be 425 ft. long and 120 ft. above the river.

PITTSBURG, PA.—A contract has been given by the Pittsburg & Lake Erie for building a concrete bridge over Turtle creek on the Monongahela division, to consist of three 36-ft. arches to carry five tracks, to the Dravo Contracting Co., to replace the present structure carrying two tracks. A contract has also been let for a bridge over Brady's run at Bridgewater, near Beaver Falls, to consist of two arches of 20 ft. each and one of 28 ft. to carry four tracks, to Stratton-Lewis & Co. The same company recently let the contract for a two-track steel bridge over the Shenango river at Newcastle Junction, and an addition to the present double-track bridge, making it four-track. The company is four-tracking many of its bridges on the main line north of Pittsburg and double-tracking those on the division south of Pittsburg. A contract has also been let to Robert A. Cummings for building a concrete retaining wall along the river road at Esplan Borough.

PITTSTON, PA.—The Warwick Iron & Steel Co. will at once begin building a steel bridge 600 ft. long on concrete piers over the Schuylkill river; it will be used to carry cars containing slag from its furnace to North Coventry.

SIOUX CITY, IOWA.—Plans are being made for building a subway on Iowa street under the tracks with approaches and superstructure about 1,600 ft. long, to cost about $255,000.

TACOMA, WASH.—The County Commissioner of Pierce County, Wash., has extended to November 24 the time for receiving bids for

the piling work on Lincoln avenue and building a drawbridge over Hylebos creek near Tacoma. A. J. Weisbach is Deputy County Commissioner.

THREE RIVERS, QUE.—An officer of the St. Maurice Valley writes that this company will build a steel deck truss bridge at Head Race 112 ft. long; also a steel arch bridge 270 ft. long over the St. Maurice river at the Gorge crossing, and a second bridge over the same river to consist of seven spans each 150 ft. long. W. S. Hart, of this place, is Secretary and Treasurer.

TOPEKA, KAN.—The Atchison, Topeka & Santa Fe and the Topeka Street Railway Co. are planning to jointly build a viaduct over the tracks of the former at Branner street.

TORONTO, ONT.—The City Engineer has recommended to the Board of Control the building of a swing bridge or a rolling lift bridge over the western gap, to be used as a street car route to the island. The cost of the bridge will be about $200,000.

Other Structures.

BATTLE CREEK, MICH.—The Grand Trunk is putting up a stone passenger station 250 ft. long to cost $100,000.

FAITHHORN, ILL.—A contract has been given by the Chicago Southern to Magnus Yeager, of Danville, Ill., at $400,000 to build a new roundhouse, station, offices and other buildings at this place, which is 10 miles south of Chicago Heights.

KALAMAZOO, MICH.—The Grand Rapids & Indiana Railroad has bought 40 acres of land at Kalamazoo and is planning to make extensive improvements in the spring, including a new roundhouse, a water tank, coal sheds and other buildings.

LYNCHBURG, VA.—The Southern Railway has agreed to build an additional receiving freight house 25 ft. x 420 ft. here.

MALONE, N. Y.—The New York Central & Hudson River, it is said, has plans ready for putting up shops here to cost $170,000.

PINE BLUFF, ARK.—The St. Louis, Iron Mountain & Southern and the St. Louis Southwestern will jointly build a union station at this place.

PUEBLO, COLO.—The Denver & Rio Grande has bought about 93 acres of land as a site on which it will build new shops and a roundhouse at a cost of about $300,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BANGOR & AROOSTOOK (NORTHERN MAINE SEAPORT).—This company has completed its line from Lagrange south to Stockton and Searsport, on Penobscot Bay, and an officer says that the road will be in operation some time this month, probably on the 20th. Completion of this line gives the Bangor & Aroostook a tidewater connection. A branch line, under the name of the Bangor Terminal, is being built from the town of Hermon, in Penobscot County, east to Bangor, which will give an entrance into that city. From the southern terminus of the road on Penobscot Bay, a line of steamers will be run to Boston and New York.

BOSTON ELEVATED.—This company has reached an agreement with the city officials of Boston, subject to the approval of the City Council, for building two two-track subways between Harvard Square, Cambridge, and Boston. One line will be through Massachusetts avenue and Main street to the new Cambridge bridge, and the other through Cambridge street to the new Charles river dam.

BROOKLYN GRADE CROSSING COMMISSION.—The lowest bid for the work on section No. 2 of the Brighton Beach improvements, which calls for the depressing of about 6,800 ft. of roadbed and elevating rails from Avenue G to Church avenue, Flatbush, is said to be that of Charles Crawford, whose bid was $509,000, which was $9,000 less than the next lowest bidder. It is the intention to begin work this fall and have it completed by May 1, 1907. At one point in section No. 2, the Brighton Beach tracks will be raised to go over the Long Island tracks near Vandeveer Park, the former's tracks being depressed at that point.

CANADIAN PACIFIC.—This company is building an extension of the Crow's Nest Pass branch to Macleod, Alberta.

CENTRAL RAILWAY OF OREGON.—This company, which was incorporated last June in Oregon, with a capital of $2,000,000, has recently issued bonds to carry out the work of building its proposed belt line in the Grande Ronde valley, Union County, Ore. The proposed line will connect Elgin, Cove, Union, Hot Lake and La Grande, and will be a feeder for the O. R. R. & N.

CHICAGO & NORTH-WESTERN.—See Wyoming & Northwestern.

CHICAGO, MILWAUKEE & ST. PAUL.—See White River Valley.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—A contract is reported let by this company to O. D. Guilfoil, of Terre Haute, Ind., for grading and filling on its road from Burnett, Ind., to Carbon, and for laying a second track for a distance of about 10 miles on this section of the road. The double track work from Markles Station to Burnett has been completed by Contractor Wells, of St. Louis.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—This company, it is said, has given a contract to the Kenefick, Hammond & Quigley Construction Co., of Kansas City, Mo., for building its proposed road from De Quincy, La., on the Kansas City Southern, east to Baton Rouge, a distance of 250 miles, with a southern branch 50 miles long to connect with the Southern Pacific. (November 3, p. 143.)

DECATUR, SULLIVAN & MATTOON TRANSIT.—An officer writes that this company has been granted a charter in Illinois, but has not as yet determined the route of its proposed electric railroad, which is to run from Decatur, Ill., southeast to Mattoon, a distance of about 42 miles. The character of the work will be light, maximum grades being 1 per cent. and maximum curvature 2 degrees. There will be one steel bridge and two trestles. No contracts have yet been let. A. B. Starbuck, of Mattoon, Ill., is President; J. M. Clokey, Vice-President, and W. A. Steele, Secretary and Treasurer. (October 27, p. 134.)

DEEPWATER.—See Tidewater below.

FULTON COUNTY NARROW GAGE.—This company has changed its road from narrow to standard gage from Galesburg to Lewiston, Ill., 50 miles. The rest of the road, from the latter point to Havana, on the Illinois river, will be widened next spring.

GILA VALLEY, GLOBE & NORTHERN.—This company has given a contract to Sherer & Co., of Los Angeles, Cal., for rebuilding its line from San Carlos to Fort Thomas, a distance of 31 miles. The line will leave the river at San Carlos and follow higher ground above the flood level for the entire distance; and will be straightened and leveled.

KANSAS CITY, GALVESTON & MEXICO.—A charter has been granted a company under this name in Oklahoma Territory, with a capital of $10,000,000, and offices at Guthrie, Kansas City, Mexico City and New York, to build a railroad from Kansas City to Port Progresso, State of Yucatan, Mex. The proposed main line is through Kansas, Indian Territory and Texas, passing through Denison, Dallas, Waco, Austin and San Antonio. Three branches are also proposed. One from Wagoner and Sapulpa, Ind. T., west to Guthrie; another from Dallas west to Fort Worth, and a third from Austin to Houston and Galveston. The incorporators are: G. V. Pattison, H. W. Pentecost, N. D. McGinley and others, of Guthrie.

KANSAS CITY SOUTHERN.—Surveys, it is said, have been completed by this company for a line eight miles long from its Lake Charles line west to Sulphur, La.

NORTH CAROLINA CONNECTING.—The incorporators of this company, mentioned last week, include: D. W. Gunn, of Roanoke, La.; D. J. Nysewander and S. P. Douglas, of Toledo, Ohio; T. F. Whittlesy, of Mobile, Ala.; W. H. Hood and R. H. Hood, of Henderson.

NORTHERN MAINE SEAPORT.—See Bangor & Aroostook above.

OGLESBY & GRANVILLE.—A contract is reported let by this company to the Gentry Construction Co., of Chicago, for building its proposed road from Oglesby, in La Salle County, Ill., west to Granville, in Putnam County, a distance of 12 miles. Grading has been commenced. S. T. Crapo, Chicago, is President, and D. C. Dunlock, Granville, Ill., is Chief Engineer.

OKLAHOMA CENTRAL.—Announcement has been made that this company has let contracts for work on its proposed road from Lehigh to Chickasha, Ind. T., as follows: M. B. Ryan, of Shawnee, Okla. T., all the bridges, trestles and culverts; E. N. Taylor, of Atoka, Ind. T., 400,000 ties and pilings; Walls, Hale & Crain, for grading the first 11 miles out of Lehigh; A. B. McKinley, all bridges and timber for the first three miles; and to the Wisconsin Bridge & Iron Co., Chicago, for building a steel bridge 86 ft. long over Leader creek. W. J. Terry, of Ada, Ind. T., will have charge of the construction work.

PACIFIC & IDAHO NORTHERN.—This company, which operates a line from Weiser, Idaho, to Council, a distance of 60 miles, has given a contract to J. W. & B. W. Slick, of Salt Lake, to grade 6½ miles north from Council. The contract calls for the completion of the work within 90 days. Grading has already been completed on an additional 8½ miles, and track laying will soon be commenced on this section. (June 16, p. 199.)

PENNSYLVANIA.—This company has agreed with the city authorities of Philadelphia for the elevation of its tracks in that city from Venango street to Norris street. From Venango street to Cambria street there will be an embankment walled by masonry, and from that point to Norris street a steel viaduct. The

Philadelphia & Reading tracks will pass under the structure at Trenton avenue near Lehigh avenue. Bids, it is said, are being asked by the Pennsylvania for the work. The cost is estimated at $1,500,000, of which the city will pay $750,000.

This company proposes to extend and improve the west-bound classification yard at Hollidaysburg. The work is extensive, but the plans have not yet been completed.

Pine Bluff, North & South.—This company, which was organized in Arkansas to build a railroad from Point Pleasant, Ark., to Roanoke, 46 miles, has decided to begin work at once. Z. Orte is President. (April 21, p. 131.)

Pittsburg, Binghamton & Eastern.—E. W. Sawyer, Superintendent of this company, says that work will at once be started on the road. Three construction crews will be organized. One between Canton and Ansonia, where connection is to be made with the Buffalo & Susquehanna; another will work from Towanda east and west, and the third from Binghamton westward. An auxiliary company —the Central Pennsylvania Coal Co.—has been organized, and has leased 7,000 acres of coal fields in Lycoming and Tioga Counties. A branch railroad will be built south from the main line to these coal fields. (August 18, p. 55.)

Providence & Burrillville Street.—This company has opened its new electric line from Providence, R. I., north to Woonsocket, a distance of 14 miles.

St. Maurice Valley.—An officer writes confirming the report that this company has given a contract to Ross & McRae for building its proposed railroad from Three Rivers, Que., northwest to Shawinigan Falls, following the south bank of the St. Maurice river and crossing at Grés Rapids, approximately 22 miles. Ten miles of the proposed route consists of prairie work, and the balance of heavy clay and rock work . The grades northbound will be 1 per cent., and 0.5 per cent. southbound, with a maximum curvature of 8 degrees. The work includes the building of a steel deck truss bridge at Head Race, 112 ft. long; at the Gorge crossing of the St. Maurice river, a steel bridge 270 ft. long, and at a second crossing of the same river a bridge of seven spans, each 150 ft. long. W. S. Hart, of Three Rivers, is Secretary and Treasurer of the company. (October 20, p. 127.)

Tidewater.—This company, which proposes to build a railroad from tidewater at Norfolk, Va., west to the western boundary of Virginia, where Mercer County, W. Va., joins Giles County, Va., a distance of 350 miles, has 100 miles under construction from Norfolk west, and has recently asked for bids to build from that point westward. This road is being built in connection with the Deepwater, which will continue the line from the Virginia state line about 110 miles to Deepwater, W. Va.

White River Valley (C., M. & St. P.).—This company has put in operation its new line from Chamberlain, S. Dak., on the Chicago, Milwaukee & St. Paul, west to Presho, a distance of 40 miles. The road will be extended west an additional 160 miles to Rapid City. (April 28, p. 144.)

Wise Terminal.—This company, which owns a line 6 miles long, running from Norton in Wise County, Va., north to Glamorgan, Va., is putting in a new connection with the Norfolk & Western at Norton. This road recently ran a preliminary survey from its terminus at Glamorgan north to a connection with the proposed extension of the Chesapeake & Ohio's Big Sandy branch from Pikeville, Ky. It will probably make location this winter and be ready to commence work in the spring. The new line will open up a rich coal and timber district.

Wyoming & Northwestern (C. & N. W.).—An officer writes regarding the extension being built by this company from Casper, Wyo., northwest via Wolton and Shoshoni, a new town, thence southwest to Lander, approximately 145 miles, that work is now under way by the Kilpatrick Bros. & Collins Contracting Co., of Beatrice, Neb., which has the contract for all the construction, except the buildings. Eight miles of track have been laid. E. C. Carter, Chief Engineer, Chicago, Ill.

RAILROAD CORPORATION NEWS.

Atlantic Coast Electric.—The property of this company has been sold under foreclosure to A. H. Joline, for a price said to be $700,000. (June 23, p. 207; June 30, p. 216.)

Bangor & Aroostook.—The gross earnings of this road for the year ending June 30 were $2,159,072, an increase over the figures for last year of $143,716. Net earnings were $782,359, an increase of $25,945. One hundred and five thousand dollars was paid for betterments, this being an increase of $25,500. The surplus after charges was $125,999, an increase of $9,155.

Canadian Pacific.—The gross earnings increased in September, 1905, as compared with September, 1904, $651,699, and the increase in net was $507,202. Corresponding increases in the figures for the three months ended September 30 were $1,204,536 and $959,040. The comparatively large increases in net earnings thus shown are due to the fact that this year the Canadian wheat crop is so large that the road has been able to move a large quantity of it before such cold weather sets in as to make operating expenses large.

This company has leased the Tilsonburg, Lake Erie & Pacific, and will take possession November 15. The road runs from Port Burwell to Ingersoll, Ont., 35 miles, and has $400,000 stock and an authorized funded debt of $875,000.

Detroit & Mackinac.—The annual report for the year ended June 30, 1905, shows gross earnings of $990,555, an increase over the previous year of $9,240, and operating expenses of $635,071, an increase of $31,914, leaving net earnings of $355,484, a decrease of $22,674.

Gainesville Midland.—The stockholders have authorized an issue of $625,000 5 per cent. 30 year bonds, the proceeds of the sale of which are to be used to pay for the extension from Jefferson, Ga., to Athens, 19 miles, and to retire the present issue of $225,000 6 per cent. bonds of 1909.

Illinois Central.—The gross earnings for the three months ended September 30 were $11,724,891, a decrease, as compared with the same period last year, of $635,208. The net earnings were $3,081,723, an increase of $876,859.

Louisiana & Arkansas.—During the year ended June 30, 1905, gross earnings increased from $704,671 to $844,536. Operating expenses were $521,712, an increase of $33,917, making the increase in net earnings $105,947. The surplus for the year was $201,522, an increase of $86,065. There was a large decrease in the value of improvements charged to capital and in the maintenance of way account. There were 20 miles more operated than in 1904.

Norfolk & Western.—The gross earnings for the three months ended September 30 were $6,920,295, an increase over the figures for 1904 of $1,150,403, or about 20 per cent. The operating expenses were $4,204,823, an increase of $841,086, leaving net earnings of $2,715,472, an increase of $309,317. The operating ratio for this period increased from 58 per cent. to 61 per cent.

Raleigh & Charleston.—This company has been incorporated with a capital of $850,000 as a reorganization of the Carolina Northern, which was recently sold at a receiver's sale. The Carolina Northern runs from Lumberton, N. C., to Marion, S. C., 40 miles, and has $500,000 capital stock outstanding.

Reading.—The September gross earnings of this company, whose properties consist of the Philadelphia & Reading Railway and the Philadelphia & Reading Coal & Iron Co., were $6,076,478. This amount is the largest on record except that for last May, which was $7,192,524. These results are due more to the prosperity in the coal trade than to any great increase in the earnings of the railroad. In May, the output of anthracite coal by the Reading was 1,262,074 tons, the total output of all other companies being 6,005,158 tons. In September, the figures were 1,067,916 tons and 5,082,232 tons respectively. The gross earnings of the company during September, 1904, were $4,789,696. The net earnings for September, 1905, were $1,852,684, as compared with $1,955,435 during May. The gross earnings of the Philadelphia & Reading Railway during September, 1905, were $3,509,358, as compared with $3,550,477 for May, 1905, and $2,817,874 for September, 1904. The net earnings for the three periods were respectively $1,593,212, $1,522,398 and $1,259,657. The surplus over fixed charges of the Reading Co. for September, 1905, was $984,184. Deducting from this amount $233,334, which is one-twelfth of the annual dividend on the $70,000,000 first and second preferred stocks, there is left $750,851 available for dividends on the common stock. This figure shows that the company is at present earning at the rate of 12 per cent. per year on its common stock, it having earned about 10 per cent. on the common stock during the year ended June 30, 1905. The trading in this stock on the New York Stock Exchange has been very active since June 30. At that date it was quoted at 99½ and it is now about 140; 24 points of this advance having been made during the last two months and 16 during the last two weeks.

Southern Pacific.—The increase in gross earnings for the three months ended September 30 was $2,615,891, and in net earnings $1,273,933. For the month of September, the increase in gross earnings was $744,709, and in net earnings, $296,493.

Union Pacific.—During the quarter ended September 30, gross earnings increased $2,518,406, and net earnings, $1,324,247. The increases in gross and net for the month of September were $781,650 and $405,263 respectively.